

# AVIATION

*The Oldest American Aeronautical Magazine*

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The Oldest American Aeronautical Magazine

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Note the pilot chute. How—naturally—it has sprung to action. How—naturally—it holds the apex of the main chute out into the line of flight, as Lieut. Ross moves away from the ship he has just left, thus also insuring the proper deployment of the canopy.

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"The Life-Preserver of the Air"



AUTOGIRO TAKING OFF FROM PIER 34, NEW YORK, WITH JOHN DE LA CIERA, DECEMBER 20, 1931 (INTERNATIONAL NEWSBUREAU PHOTO)

*Prophetic Achievements*



With many amazing things that Autogiros are doing almost daily should no longer be appraised as "stunts"—they are practical examples of useful applications of the Autogiro beyond the limitations of previous aircraft.

When an Autogiro landed and took off from the lawn of the White House it was something only because it was the White House. Many Autogiros make practical use of the lawns of many estates. When two Autogiros land and take off from a city street on the Philadelphia waterfront, it is heralded as a "stunt" only because it is the first time a sea captain has been able to use an aircraft to transport

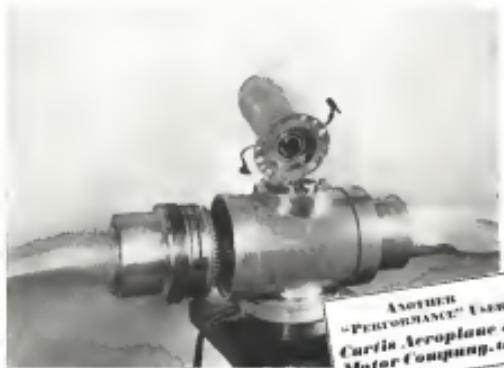
him to his pier. But actually it was a practical demonstration of the feasibility (with adequate provisions) of using Autogiros to land passengers almost at the gangplank of an ocean liner.

When another Autogiro recently landed on a New York pier to meet Juan de la Ciera, its inventor, upon his arrival from Europe, and took off again with him for Philadelphia, it was merely another demonstration of the ability of the Autogiro to directly link air and water transportation.

Those who are responsible for the success of the Autogiro, value public interest in these demonstrations only as it is translated into an understanding of how vastly the Autogiro extends the practical usefulness of air transportation.

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*as on the highways  
for the last 30 years!*



*"Guaranteed  
Forgings"*

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# When Larger Planes Fly...

AIR transportation has already established a tradition and a record. We are able now to deal with something more tangible than prophecy. We know that when a plane takes off, it is going somewhere, usually with paying passengers or valuable cargo, guided along its way by professional operators and scientific equipment. It figures in important statistics both as an industry and as an accepted means of dependable rapid transportation.

Where does aviation go from this point?

In all probability it will continue as it is going now, simply extending its range, improving its material, becoming more efficient in all its activities to meet the needs of a world that looks to it seriously to solve many modern problems. Its chief advance will be in dimension. Larger planes will have to be built to accommodate larger numbers of travelers at lower cost for transportation. Larger planes must mean greater mechanical efficiency and lower proportionate operating costs.

The great success of the Ford tri-motored, all-metal plane, which pioneered the airways, plainly indicates the future Ford. Larger Ford planes will soon lead the way.

F O R D M O T O R C O M P A N Y



## The aircraft industry

### reads its future

#### in the figures

**T**HIS is the  
second statistical issue of  
AVIATION

A number of papers  
are here covered for

the first time—some of them, we believe,

for the first time in the history of

American aviation. The problem of

preparing such a compilation gives

more room for the more exact, more

varied and accurate, the more complete

of the results ought to be steadily

increasing. It is possible to learn a

great deal by a comparison with the

results of past years that could not pos-

sibly be drawn from any single study,

however accurate.

There are a few processes to which we

want to give special attention, because

of our conviction that they deserve it,

and that the information set forth and

the conclusions drawn are of immediate

importance and immediate use to the

operators and manufacturers of aircraft

in making their current decisions.

These are two studies of

density of passenger traffic and of fre-

quency on air transport lines, particu-

larly the former. They appear on pages

104 and 105. A glance at the maps

will show where centers of gravity of

public interest lie, and how successful

the policies of the various operators

have been in developing public pat-

ronage.

Of great interest to transport opera-

tors, also, is the analysis of govern-

mental expenditures on civil aviation

and the relation to the development of

traffic in all the leading air routes of

the world, printed on page 106.

Building of planes for military use,

government officials, and the plane en-

gineers interested in the development

of civil aviation will find on page 124

what we believe to be the most complete

tabulation recently published in England

of the military and naval activities of

all the countries of the world.

For manufacturers of consumer air

aircraft, and of distributors, dealers and

operators of flying services, we print on

page 125 an analysis based on

three consecutive years of close analysis

of all licensed aircraft, on the

question of average life and of rate of

implementation of machines in various

classes of service. It is supplemented

by a study, the first of its kind, of the

cost of maintenance and of the cost of

the types of craft that each group has

favored. That appears on page 126.

After putting with a modest degree

of pride to a few of the high spots of

the issue, there remain two obligations—

to make general acknowledgement of

assistance and to record the various

sources of general information on air-

plane use. The first obligation is a

very pleasant one. Indeed, as usual,

our principal debt is to the Department

of Commerce and the Aeronautical

Chamber of Commerce. The Aeronau-

tal Branch, the Aircraft and Trade

Division of the Bureau of Foreign and

Domestic Commerce, and the Chamber

of Commerce, all have been of great

assistance. They have been instrumental

in putting original material at our dis-

posal, that we might make use of it

as we could. We are equally appreciative

of the assistance of the National Ad-

visory Committee for Aviation, the

Air Mail Corps, the Motor Bureau of

Commerce, and a number of other

government committees and offices

of the aeronautical corporation of the

Canadian Director of Civil Aviation

and of the aeronautics ramified in direct

correspondence by issue (twice

through government)—of the efforts of

the various operators engaged in the

air service operators in the United States

who have responded to our questions

about their own activities. The work

could not have been done without every-

one's help. We hope that those who

have helped will find the results of

our work useful in partly the trouble

that they have taken.

It is impossible to hope that no ex-

ceptionally numerous and

admirable traffic will be

developed in the future. We

shall be glad to

correct in succeeding issues of AVIATION

any that seems to be of significance.

## Air transport

How does it progress? And where most rapidly?

THE year just passed has shown no very extraordinary changes in the air transport figures. Passenger mileage increased some 20 per cent, the first year since 1945 in which it has failed to double the previous year's record. Obviously, no such rate of progression can be maintained for long. The Airline mileage made a slightly larger increase, the average number of passengers in all transport flights as a whole (including those on which no passengers were carried) increasing between two and one half per cent. The average load per passenger, current record being 19 per cent. The average load per passenger was therefore almost exactly the same as in 1952.

There are no official statistics in the United States which give an accurate basis for the measurement of the volume of mail and express. Five per cent appreciation is better than no figures on that point, however, and an appreciation has been secured by estimating the average distance travelled by the average point of mail on each mail route in terms of the past five years. Equally, there are no official statistics on passengers using up to get a total. It appears that at the aggregate the non-schedule represented by passenger traffic is about 70 per cent of the total of transport between the field, and this coming was to some extent compensated for by the increase in mail and express, the contribution of which was increasing schedules. The line of division between and carrying and mail-carrying operators was more sharply drawn.

The American mileage statistic

for eighteen months. Operations are, however, much more concentrated and carried on with more regularity now than in the summer of 1950. The mileage actually flown in accordance with schedules should probably increase at least 25 per cent since that time.

### Frequency of service

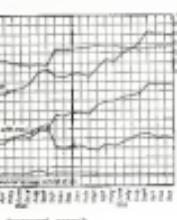
Passenger traffic in the United States is still on a very high day-schedule basis in most cases as the map at the top of page 305 graphically reminds us. While it is analogous as that, only a minority of the passengers travel on a schedule, those between cities and other destinations happen to coincide with the airline's schedule. There are only about 5,500 miles in the United States over which more than two round trips per day are offered for passengers. Really high frequency is confined to some 2,200 miles, mostly well scattered over the country.

There is much less to complain of in terms of air mail frequency (mapped on page 304). It is hardly surprising to see a marked increase during the past year, but it is reported almost exactly constant at 65. The nature of the airmail mileage, however, changed considerably. More independent came into the field, and this coming was to some extent compensated for by the increase in mail and express, the contribution of which was increasing schedules. The line of division between and carrying and mail-carrying operators was more sharply drawn.

Roundly speaking, these schedules in any case are as good as can be expected in terms of mail service, except in those routes. It is of course natural that the air mail route should show a little hollowness, and a more eastern schedule development, than the passenger routes. At the present time, the number of air mail routes is about 100, mostly in the central control of the Post Office Department and are planned as a whole. Most of the first-class route lines now have at least two schedules a day, and many of them have three.

### Passenger traffic

ON the lower part of page 305 passenger traffic is often referred to as the first analysis of value of air passenger traffic that has been less prepared in graphical form for the United States. It has necessarily been based only on the first six months of 1951, the returns for the last half not yet being available. It is, with a few exceptions, a picture of a great deal of extra remunerative success in density of traffic between Cleveland, Detroit, and Chicago, and between Los Angeles and San Francisco.



Passenger miles of air transport growth



The form in which reports are now made to the Department of Commerce makes it impossible to divide the traffic accurately in respect to the individual parts of the system basis. It has been necessary, for example, to measure the total on the Boeing line as uniformly distributed loops Chicago to San Francisco. The weight of the lines as the map, however, is not based simply on the total number of passengers flying over some part of the line. Due allowances are made for the fact that often there travel only a fraction of the total length. The figure of passenger miles, rather than that of total passengers, has been used as a basis of calculation, and the only remaining error is in the assumption that an T & W A, for example, carries just as many passengers as the segments on the stretch between Chicago and Albuquerque as between St. Louis and Colcord. While some error is involved in such an assumption, it is not believed that it is very serious, or that it is at all appreciable except in a few cases. Much more detail is given in the accompanying graphs.

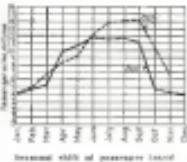
The special value of such a map, however, is not in its exact mathematical interpretation, but in that it presents the gaining of a general idea of the general basis of traffic and shows which destinations are being best served. The presentation on page 305 also gives, twice annually, sorted for that purpose.

The width of the lines on the map could not be made directly proportional to the volume of traffic where the traffic was very heavy, as it would have required lines of such great width, a part of the map would be very cluttered. The weight of line used for any number of passengers up to ten per day is indicated on the page itself. Beyond ten it was made proportional to the square root of the number of passengers, the line for 50 passengers per day, for example, being twice as wide as that for ten. The individual routes and parts of routes having the heaviest traffic are.

### Passengers carried per day

New York-Philadelphia	111
New York-Baltimore	34
New York-Washington	8
New York-Chicago	21
New York-Detroit	20
Chicago-Chicago	25
Chicago-Detroit	12
Chicago-Los Angeles	30
New York-Los Angeles	20
New York-San Francisco	31
San Francisco-San Francisco	26

Passenger miles



the north-southesterly routes from Chicago through St. Louis and Kansas City to Dallas and Galveston, and northwesterly lines from Chicago to the Twin Cities, and the route from San Francisco and Los Angeles, include all the spans of the country that were averaging as many as 100,000 passengers per day in the first half of last year.

A comparison of traffic for the same month in the present year has been made for a few of the major routes.

### Average number of passengers carried daily

From/To	From/To
New York-Philadelphia	34
New York-Baltimore	8
New York-Chicago	21
New York-Detroit	20
Chicago-Chicago	25
Chicago-Detroit	12
Chicago-Los Angeles	30
New York-San Francisco	31
San Francisco-San Francisco	26

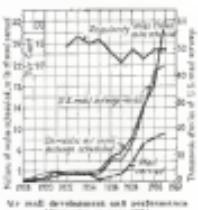
There has been a general falling off in traffic on the routes that were most heavily travelled in the first half of 1951, such as Cleveland-Detroit and Los Angeles-San Francisco, and new heavier lines New York-Washington and New York-Chicago have come to take place among the leaders. It appears, however, that that trend in no sense indicates better results for the mail. The individual routes and parts of routes having the heaviest traffic are.

of those in the continental United States in traffic density.

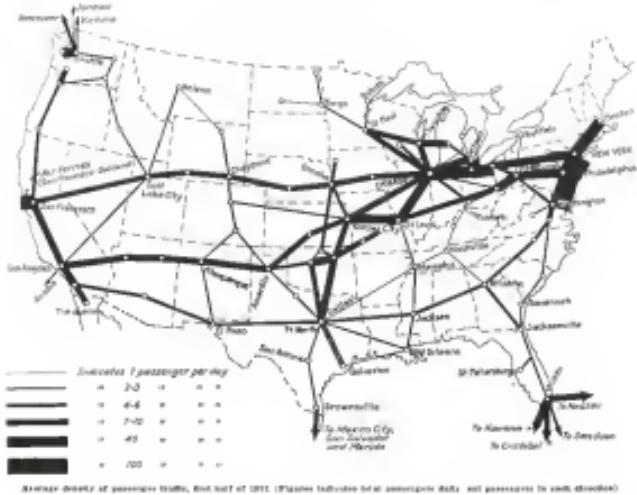
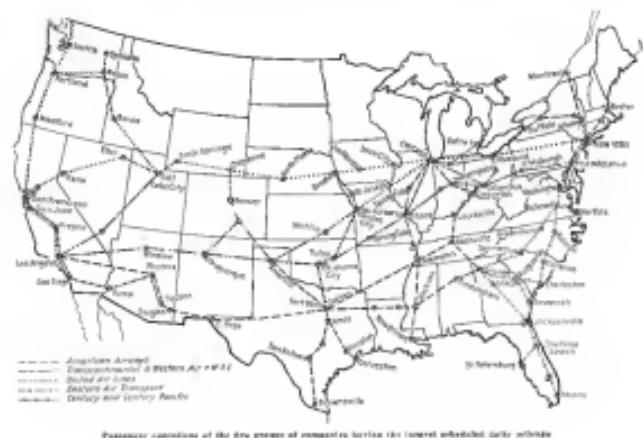
On the whole, the extreme concentration of traffic on a few routes is distinctly fewer now. While a few new cities in the map are not yet in the map, and some which are now in the map, have not yet come in, the number of cities using similar methods, has decreased.

### Group ownership

THE map on page 304 showing the ownership and frequency of operation of the air mail lines and of a growing group of passenger lines, speaks for themselves. In the case of the passenger lines alone, the Delta Air Lines by far the largest carrier within the United States each day has been included. The passenger line is particularly striking as a reminder that, although the selection of routes by the Postmaster General has been effective in eliminating the mail, the direct competition among the major operators for passenger business, there remains a vast



amount of redundant competition. There are only a few instances in which two or more major lines parallel routes, or carry to another, but in many cases, particularly in the eastern and southern parts of the country and on the transcontinental routes, it is possible to travel between two cities 600 miles or more apart by two or more routes not differing by over 20 per cent in mileage. It is, however, the major lines which seem to be concerned in this starting point to expand by the direct and the "overhead" air routes are more nearly the same than are the subroutes of the two methods most directly competing over the same route.



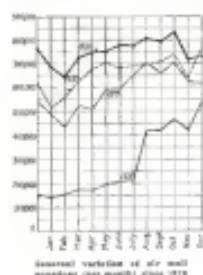
**Air mail**

**The Waters Act as its workings**

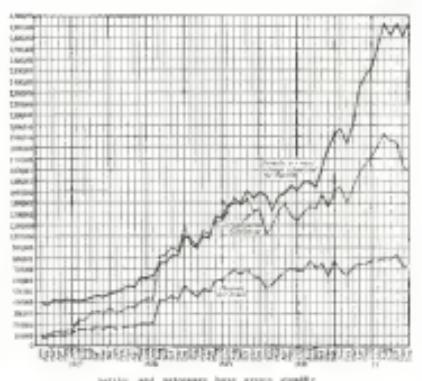


**AIR MAIL** operations and traffic during 1931 followed a course which was decided contrast to the general trend of business for the year. An increase in scheduled mileage in great as was made during the two preceding years is recorded. Most of the increase was due to increased frequency of services. No less striking, however, is the New York-Chicago-San Francisco. A number of new routes, most of them short, were opened. After the usual dip in February the mail was transported until the suspension of revenue services between September and a slight increase in December. Following a new high in August, the mail, unusually bad flying weather during the last two months of the year reduced the gains.

Minor fluctuations in the curves are frequently due to the varying lengths of the routes. February is the best month because it starts with 10 per cent backlog as against January.



Average variation of air mail percentage from January 1930 to December 1931



Actual and percentage have grown steadily

October, sitting in between two 30-day months, always looks relatively good.

**Rate of traffic increase**

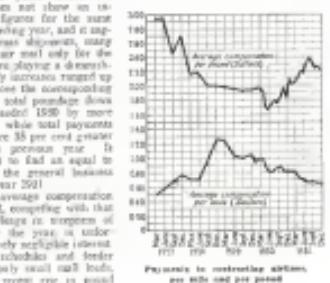
The curve of air mail percentage continues to rise steadily at a steady rate throughout 1931 with only the approximately seasonal drops with the exception of December.

At the end of 1931 the percentage average is lower than it was in the previous three and a half years.

**Falling increase per mile**

The revision of rates that the Post Office Department made on Jan. 1 will sustain a position well above any previous year for every month except December. This is only the second time in the history of the air mail service that the rate of increase in the monthly total does not show an increase over the figure for the same month of the preceding year, and it suggests that Christmas shipments, among them sent by air mail, will be the outstanding factor in carrying the increasing part. Monthly increases ranged up to 35 per cent above the corresponding 1930 levels. The total percentage shown during 1931 exceeded 1930 by more than 10 per cent, while total payments to contractors were 35 per cent greater than in 1930. It is difficult to say if this would be difficult to find an equal to this increase in the general business volume of the year 1931.

The curve of average compensation per pound carried, excepting that for scheduled mileage is irregular at times during the year, is, in addition, irregular in the monthly movement. Numerous new schedules and feeder entries only small and looks account for the recent rise in pound



Percentage to nonstop flights, per mile and per pound

**Mail carried by routes for 1931**

Airline	Actual flights	Percent of scheduled air line flights	Total weight of mail dispatched (pounds)		Average weight per scheduled air line flight	Average mail per customer	Average customer weight per air line flight	Average customer weight per air line flight
			(lb.)	(lb.)				
<b>American Airways</b>								
1 Boston-New York	224,343	87.1	134,220	134,221	600	1,014,344	100	1,014,344
2 Boston-Baltimore	10,347	3.8	10,347	10,347	1,000	1,000	100	1,000
3 Boston-Boston	433,428	42.4	433,428	433,428	1,000	1,000	100	1,000
20 New York-Toronto	1,013,083	10.6	1,013,083	1,013,083	100	100	100	100
21 Dallas-Gulfport	204,740	23.1	204,740	204,740	1,000	1,000	100	1,000
22 Dallas-Kansas City	204,740	47.5	204,740	204,740	1,000	1,000	100	1,000
23 Atlanta-New Orleans	334,329	341,017	10.8	334,329	100	100	100	100
24 Chicago-Cleveland	403,883	131,412	90.2	39,023	27,238	114	24,861	112
25 New Orleans-Baltimore	178,159	178,159	90.4	31,024	14,714	149	14,886	147
26 New Orleans-Boston	1,332,220	1,259,787	90.7	338,949	314,519	742	20,725	20
27 Atlanta-Los Angeles	91,038	109,429	10.8	24,000	10,147	328	1,000,000	21
<b>Total</b>	<b>388,419</b>	<b>3,614,643</b>	<b>82.0</b>	<b>4,236,092</b>	<b>1,000,000</b>	<b>1</b>	<b>4,435,260</b>	<b>100</b>
<b>Eastern Air Transport</b>								
19 San Francisco-Baltimore	1,410,448	1,224,701	92.8	1,000,000	100	1,000,000	100	1,000,000
20 Standard Air Transport	144,467	144,467	10.8	144,467	144,467	100	144,467	100
21 Standard Air Lines	1,049,420	1,042,486	91.2	1,000,000	100	1,000,000	100	1,000,000
22 Standard Airways	3 Chicago-Panama	1,000	1,000	1,000	1,000	1,000	1,000	1,000
23 Standard Airways	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
24 Standard Airways	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
25 Standard Airways	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
26 Standard Airways	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
27 Standard Airways	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
<b>Total</b>	<b>1,410,448</b>	<b>1,410,448</b>	<b>92.0</b>	<b>1,000,000</b>	<b>1,000,000</b>	<b>1</b>	<b>1,000,000</b>	<b>100</b>
<b>Trans World Airlines</b>								
28 Chicago-Panama	409,044	399,404	89.5	90,111	45,052	90	100,000	90
29 Pan American	1,341,537	1,151,191	92.7	90,570	100,000	100	100,000	100
30 Pan American	1,341,537	1,151,238	91.6	90,570	100,000	100	100,000	100
31 Pan American	1,341,537	1,151,238	91.6	90,570	100,000	100	100,000	100
32 Pan American	1,341,537	1,151,238	91.6	90,570	100,000	100	100,000	100
33 Pan American	1,341,537	1,151,238	91.6	90,570	100,000	100	100,000	100
34 Pan American	1,341,537	1,151,238	91.6	90,570	100,000	100	100,000	100
<b>Total</b>	<b>1,341,537</b>	<b>1,341,537</b>	<b>91.6</b>	<b>90,570</b>	<b>100,000</b>	<b>100</b>	<b>100,000</b>	<b>100</b>
<b>United Air Lines</b>								
35 Chicago-Calgary	1,934,319	1,873,611	89.0	90,000	490,000	500	1,000,000	500
36 Chicago-Calgary	1,934,319	1,873,611	89.0	90,000	490,000	500	1,000,000	500
37 Seattle-Calgary	1,934,319	1,873,611	89.0	90,000	490,000	500	1,000,000	500
38 Seattle-Calgary	1,934,319	1,873,611	89.0	90,000	490,000	500	1,000,000	500
39 Seattle-Calgary	1,934,319	1,873,611	89.0	90,000	490,000	500	1,000,000	500
40 Seattle-Calgary	1,934,319	1,873,611	89.0	90,000	490,000	500	1,000,000	500
<b>Total</b>	<b>1,934,319</b>	<b>1,934,319</b>	<b>89.0</b>	<b>90,000</b>	<b>490,000</b>	<b>500</b>	<b>1,000,000</b>	<b>500</b>
<b>Trans World Airlines</b>								
41 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
42 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
43 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
44 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
45 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
46 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
47 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
48 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
49 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
50 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
51 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
52 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
53 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
54 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
55 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
56 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
57 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
58 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
59 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
60 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
61 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
62 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
63 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
64 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
65 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
66 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
67 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
68 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
69 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
70 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
71 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
72 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
73 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
74 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
75 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
76 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
77 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
78 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
79 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
80 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000	100	100	100
<b>Total</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>30,000</b>	<b>30,000</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Trans World Airlines</b>								
81 Los Angeles-Baltimore	30,000	30,000	100	30,000	30,000			



eastern part of the country. Naturally, airports are closer together where the larger number of points of dense population are found. In the West, there are fewer air routes and less use of land, so landing fields few and far between. New England and the Middle Atlantic states satisfy both conditions, and there is a solid block of airports, including intermediate points of Washington, D. C., Ohio, Connecticut, Vermont and Maine, that have at least one port for every 400 sq. mi. of area. No other state fulfills that condition, which it is, as a matter of fact, a very modest one. To provide reasonable safety, and without regard to the standard of port, in the event of forced landing, there naturally should be at least one landing field every 25 miles in every direction. To attain that position it is said that ports must have at least one at least one port for every 800 sq. mi. of area. Only three states have so far done this.

Four of the states were of the Mississippi approach at even committee. Others on that area, Arkansas and Oklahoma, have as much as one landing field every 1,200 sq. mi. of area. Only one has as much as one for every 2,000, although it has more than 1,000. The 2,000 sq. mi. mark on the energy line, the nearest airport 20 miles away. There are said to be some points, in each case, from which it is necessary to go at least 40 or 50 miles to reach a field. Yet that is the measure of safety as far as possible. The number of airports in the West is 1,000, in the West Coast or the forest or Montana, Idaho, Montana, South Dakota, and Minnesota.

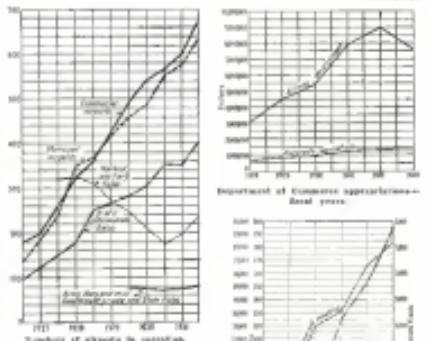
The standard that is reached by only eight states west of the Mississippi is attained by every single state to the east of that river except Kentucky and Mississippi.

#### Airfields and improvements

BY COURTESY OF THE AERONAUTICAL COUNCIL OF CONGRESS. We have been able to examine the originals of the quarterly questionnaires submitted to the Chamber, and to tabulate the data that they contain. Only a relatively small number of airports reported data on the number of passengers, but they suffice to give a general idea of the most important fields and certainly this average a larger amount of activity.

#### Airport summary

Total number of airports from which regular  
airline draws  
Average number of passengers each year  
Total number of passengers and  
airline draws from 1931 to 1933



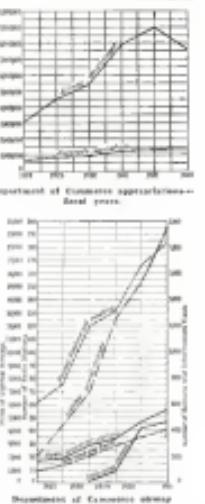
that do the entire group of American airports taken as a whole.

Taking that into account, the amount of operations per square mile is small, and the tabulated figures confirm the conclusions drawn from our own airport survey on page 138. Roughly speaking, only one-third of the field-reporting have as many as one airplane having service each day on the average. Some have as many as 100, others only eight per day, and only those two-thirds as many as 10 gal. of gas a day. With so meager a level of service, it is not surprising to find that only about a quarter claim to be making an average of 100 passengers a day.

The total number of transcontinental departures reported for the year shows an average of a little less than two per day per port, some fields of service running up to 20 or more. If it be assumed that the same is reported regarding 30 other airports, the total number of departures which appears to be a fair estimate, the total number of cross-country flights during the year can be worked out at about 270,000. If 8,500 planes be in operation, and as page 121 we conclude that the average number of passengers per plane is 30, then it may be assumed that there are about 270 cross-country flights each year—just an unconvincing figure, although a little higher than we would have been inclined to expect. Applying the same system of calculation to local flights gives an average of 400 per airplane per day. When this is multiplied with the numbers on page 114 this figure seems high, but if we take account of the machines regularly used in localizing and landing several hundred short flights each month, it appears quite reasonable.

Through the average number of ports

#### AVIATION March, 1933



#### AVIATION March, 1933

were engaged in development work of some kind. Forty-three were increasing the area of the landing field, 23 were adding runways, 20 were adding lighting equipment, 15 were adding what they call "air ports" and 10 were getting other hangar space. Although the ports that are engaged in such work are much more likely to make report than those that are not, it is fair to estimate from these figures that at least 100 ports, and possibly a greater number, of the 1,000 now have undertaken some improvement of their facilities in 1933.



#### Servicing

A COMPARATIVE survey of servicing operations of the last three years has been attempted, but no operators were able to furnish figures in comparable form for the same period that the records of the Bureau of the Treasury.

The general judgment is that the amount of servicing work increased by some 50 to 60 per cent in 1930 over 1929, and in 1931 dropped back about 10 to 20 per cent. As would be expected in view of the effort to keep old planes

operating, servicing has perhaps held up better than any other type of aeronautical activity except for transportation. The netter gross income for servicing in 1931 (not including airports) was \$1,000,000, which may be estimated to have been probably established at \$1,200,000 a year for the last two years, or more. The cut from airway development, which takes about seven times as much money as the Department's regulatory work is more

the first decrease that have ever been made in the amounts allowed for airway development and for aircraft regulation. The change in the allowance for regulation work has been probably established at \$400,000 a year for the last two years, or more. The cut from airway development, which takes about seven times as much money as the Department's regulatory work is more

#### Weather bureau

ALTHOUGH the number of aeronautical stations has increased in 1933, the increase is not as great as in 1931, with almost as high a rate as in the two previous years. The present all-inclusive list of aeronautical stations in the United States is 1,000, and the number of stations will still have to be increased by 400 per cent to take care of all America always.

In lighting work the tendency is to increase the spacing of the luminous sources. In 1932 it was a beacon operating in every state, with 100 stations of various types. At the end of 1930 the average distance is 11 miles, an increase of 2 miles in the last year. In the last two years beacons have been added at the rate of only one per year, 12 miles of newly-lighted areas.

The Budget estimates for 1933 show

#### The National Advisory Committee for Aeronautics

ALTHOUGH demands on the National Advisory Committee for services and publications continue to increase, the amount of work done by the Bureau of the Treasury in the last ten years has the amount available for the Committee's general work, including new buildings, has declined below the previous year's figure.

During 1931 the staff at Langley Field increased its growth, nevertheless

since the laboratories were founded, the service of staff, however, has been considerably less than the increase in the amount of work completed for the

#### Publications of the N.A.C.A.

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### Schools, services, and miscellaneous flying

*How much flying? And what kind?*

THE 1991 survey of flying schools in Australia has been limited to the Class A group, consisting only the Department of Commerce approved schools and a few outstanding schools which do not have that rating. Of the 26 approved schools, 21 furnished data for AVIATION Returns from a total of 25 schools are included in the survey.

Placement figures for the 1991 reports are the continued downward trend in the turnover rates and in the number of students enrolling. Other figures closely approximate those for 1990. Most of the students still fail to secure employment as professionals, but the proportion reported as planning to buy private practices is nearly double that in 1990 or 1990, which is a good sign. About 15 per cent of all students are reported to be learning to fly currently as a general responsibility, without any idea of enlarging any remuneration of it, or a clear plan as to what to do in practice years.

The reaction of the schools to use of the very light type of plane for student instruction is illuminating. Including a number of Curtiss-Wright units, 26 schools tried them in dual instruction and had good results. One reported a strong negative reaction to the type. Another used a light machine mostly as an inexpensive audience for aerobatics.

The number of new students enrolling during the year was less than half of the number for the year before. Instruction per school dropped from an average of 21 to 17, and the instructors' load increased. Each one had to handle an average of 233 students during 1931, as compared with 31 in

1931 averaged about double that of 1930. Despite the lowered fees the total student enrollment reported dropped more than 20 per cent from 1930.

It is surprising, in view of almost universal price-cutting by the schools, that there was no increase in the practice of allowing extension on a pay-as-you-go basis. Also there is a distinct drop in the number of schools testing places to graduate students seeking merely to accumulate that sum. A few years previously all of the schools required that they credit students to graduation, but this year only 25 per cent are doing it.

whether ever having an idea of entering a school or qualifying for a pilot's license, is becoming an increasing factor in the situation.

### Tabulation of flying school questionnaire answer

<sup>42</sup> The sections available represent 100% of the primary quadrat data, a measure of coverage that is not available for the secondary quadrat data. The data for the primary quadrat data are available for the 100% and 50% quadrat size areas and for one quadrat size at a time. The secondary quadrat data, however, would be difficult to obtain.



located in the northeastern United States. With minor exceptions, however, the conclusions drawn from that group would apply with satisfactory accuracy to the animals as a whole.

The most striking fact that emerges from all this work is the enormousness of most of the flying screen at a few airports, in the hands of a low cost, low maintenance, and low cost of operation. At the airport corresponding to our questionnaire, about half of all these is the country, 12 per cent are reported themselves which usually amounts to 22 per cent but had no commercial flight. In the same manner, 10 per cent of all these were reported the proportion of heavy aircraft would probably have been still larger. Almost all of the large and well-known field made response, but there is hardly any incentive to let the manager of a small field to respond to the trouble to answer to an inquiry or indeed to respond to any correspondence.

### Many migrants choose

The presence of five commercial planes does not make an airport a very busy place. Yet only 30 per cent of the fields reporting showed as much activity as that, and in six states there were none in the five plane group. Only 2 per cent had as many as a dozen planes in commercial operation.

Passing the question of concentration further, it develops that 22 per cent of the fixed-base operators on whom report was received have but one place. That is an approximate figure with the figures derived from the Department of Commerce data. Only 15 per cent of all the operators have more than this base place. Roughly speaking, 25 per cent of the airports above two-thirds of the activity, and 20 per cent of the operators have over half the places in service. The whole country, allowing for the areas from which no information was received in the present investigation, shows only about 200 fixed-base stations.

No very striking geographical differences appear in these points, except that California, with more airports than any other state in the Union, has an unusually large proportion of them in close association with very little activity, while New York has an unusually small, and Illinois an unusually large, proportion of very large, fixed-base, aerodromes.

#### **Entre Ríos de mucha felicidad**

The figures from the Department of Commerce also give similar indications of concentration. It must be remembered that they cover only 282 plants, about 100 of them engaged in transportation work. Seventy-five per cent of the total amount of business flying in the country was done by 650 owners, 36 per cent of it by two or three companies. The figures for flying schools are still more striking. Reports were studied for 746 schools engaged, according to their own reports, in engine, biplane, autogiro, and other

Where the difference between subjects one and three is not equal certain bias is due to a service and to sale, leading us to the conclusion that the data for price or unit and many others.

and those can approach schools, and these find far more opportunities as youth flying in the after 70 competition. Taking the 70 "schools" altogether, one of these had more than 40 per cent of the total amount of flying. The top ten largest schools had more than 70 per cent of all the flying done in the country.

Only 10 of the 74 had better one plane each, and were averaging less than 3 hours of flying a year.

Of the planes on which individuals compete were examined, probably representing every type of aircraft in use in the country, only 2 planes had more than 100 hours of flying.

of over 400 hours a year. Only 11 per cent was at the rate of over 200 hours, and only 35 per cent was at over 100. Excluding transport operations, it appears that about three-quarters of the total amount of flying is done by about 45 per cent of the planes.

The average amount of flying per plane was at the rate of 120 hours per year, or slightly above a general average of 200 hours in 1930. The measure of activity reported by identified planes was almost negligible. The table presents one per cent of the total of 30,000 planes. Excluding 5000 which had less than 2,000 hours of them, including the transport line stops, appear in account for 80 per cent of all the flying

Using time per phone to

The very limited amount of use that most stepladders get is still better shown by an analysis of the figures on the machines used for purposes of pleasure, either exclusively or in connection with some commercial operation. Barely 20 per cent of the owners buy as much as two hours a week, and that 20 per cent (some 6000 out of 30,000) buy 100 per cent (some 12,000) of the time the stepladders that they do. Only half of those buying without commercial interests buy as much as an hour a week.

It has been estimated from time to time since 1959 that there are about 200 flying schools in the United States. It would appear from these figures that, if the term "school" is to be interpreted as meaning an organization with any facilities other than an airplane, there are at the outside about 225 schools and very probably can exceed 250. However, on the other hand, it is no inclusion every one who attempts to give flying instruction both the amanuenses he used we are agreement in suggesting that the correct figure is about 1500.

As will be observed from the large table, in every part of the country where we have found and examined

### Analysis of aircraft operations for a selected group of planes, first six months of 1933

IMPROVEMENT ON 2000	
Number of average days in treatment	14.5
Number of days in treatment increased, actual	14.5
Total of hospital days increased	14.5
Number of total drug contraindications	100
Number of avoidable drug contraindications	100
Number of avoidable side reactions	100
Number of avoidable adverse interactions	100
Total admissions, <i>Spina Board</i>	100
Total admissions, <i>Spina Board</i> with avoidable drug contraindications, side reactions and adverse interactions	100
Overall admissions, <i>Spina Board</i>	100
Drop Discharge (100%)	100
Drop admissions and A&E (100%)	100
Discharge (100%)	100
Drop and discharge (100%)	100
Drop admissions (100%)	100
Discharge (100%)	100
Referrals (100%)	100
Other admissions (100%)	100
Total admissions, <i>Spina Board</i> (100%)	100
Number of admissions increased by 10%	100
Number of patients admitted, <i>Spina Board</i>	100
Total days in hospital, <i>Spina Board</i>	100

utilization of the figures as a whole, is that everything is spread out too thin, and that there is not nearly enough specialization.

The rather absence of any crop dusting operations in the table of course has no significance. The planes selected for analysis were all located in a section of the country where dusting is of little importance. A study in Texas and Louisiana would show very different results on that particular point.

## Die politikwissenschaftliche Kritik

As might have been expected, "loop flying" or right-answing in the most widely diffused of all flying activities. Not only are the largest number of operators engaged in it, but the number of hours of flying per month is also evenly sharing this title as is true of all other types of flying. Of 169 users in the group surveyed who reported some form of commercial activity, 46 per cent reported an average of at least a half hour a week of local passenger flying, and 6 per cent were showing over four hours a week.

annualizing was somewhat less than 60 per cent of the total operation and in some cases for as much as 90 per cent, got only 44 per cent of all the eight-hour-a-day work. It is of interest to note that among the very largest operations there tendency toward specialization is apparent, for five of the twenty-five stations most active in "box drilling," including two of the leading three, were not among the leaders in any other type of work. A possible reason for

On the whole the large operators or agents had to sacrifice to get more revenue per unit of flying time than do the small ones. Although the ten leaders had only 44 per cent of the time on "log flying," they earned 67 per cent of the passengers. The three largest operators

store, whose record use of unexceptionable accuracy, had 12 per cent of the total night-awake flying time and carried 46 per cent of the passengers. They averaged from 38 to 50 passengers per hour of flying. Presumably the usual practice is to carry from two to four passengers at a trip, but to run 28 passengers a flying hour there must be enough use of lower cabin seats.

The distribution of activity in 1951 was similar on most respects to that shown by a survey made from the same Department of Commerce records the previous year as behalf of Alvey Air. Most notable changes are the decrease of the relative importance of instruction, from three-eighths of the total hours of flying to barely a quarter and the increase of business flying from 7.3 to 9.2 per cent.



### How many licenses to fly, and how much gas tax?

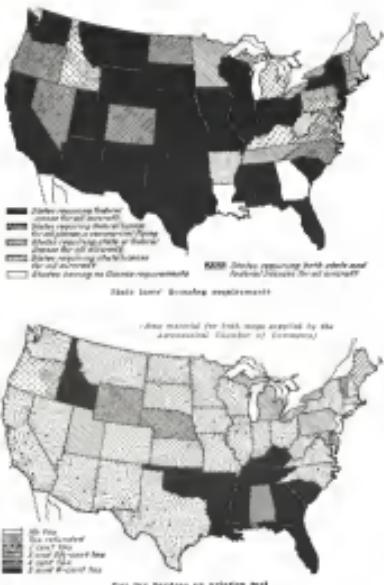
## Aviation law

the state or into the highway fund, aviation deriving no direct benefit. There are marked differences of opinion upon whether or not a tax exemption specifically for instrumental work is desirable. Some aviation interests favor it; others are virtually in opposition. It is worthy of note that the three states that are most often held up to high praise for their far-ahead aviation in

that the fuel was used in aircraft. Among the nine northern states that received grants on the basis of projected use, only Minnesota applied the grants directly and specifically to aeronautical purposes such as the building of landing fields or the lighting of airports. Relatively few of the southern states received grants which were to be used for the construction of airports, but the grants were to be used for the purchase of aircraft and for the maintenance of aircraft.

The map applies to the tax collected on fuel used in private and transient flying. In a few instances the tax is either reduced or totally cancelled in the case of fuel used in regular scheduled interstate transport, or even on fuel used in transient operation.

Obviously, as a matter of economic justice, the aeronautic world is supposed to share a tax collected on aviation fuel go into the general funds of





## Production and licensing

*Who owns all the planes? And when will they buy more?*

**PRODUCTION** of commercial aircraft in 1931, as reported to the Chamber of Commerce, was 10 per cent lower than in 1930 in number of machines, and 39 per cent lower in total value. The average value showed a drop of 25 per cent, due in large part to the fall in the value of the light aircraft. The number of new production machines have been reported annually for the past year. Forty-four per cent of all the machines produced were in a star configuration. Since before last year they exceeded 41 per cent. This year they jumped to almost 48.

### Commercial engine production and sales

Number of planes	Value		average unit value production	Sales
	Production	Sales		
Transport	900	1,021	1,021	1,020
425	205	249	981	413,391
16-25	670	541	341	1,207,054
120-175	48	137	248	140,248
120-175	10	11	11	24,000
220-385	266	128	128	130,931
385 and up	384	294	384	2,963,000
Total commercial	1,021	1,116	1,081	4,613,391
Military	1,941	1,989	1,915	10,020,425
<b>Grand total</b>	<b>3,962</b>	<b>5,105</b>	<b>3,094</b>	<b>16,623,816</b>

### Commercial aircraft production and deliveries

Number of planes	the sum of total commercial		Total value	Average unit value production
	Production	Sales		
Transport	1,021	1,021	1,020	1,021
Open cockpit transports	278	274	260	143.5
Cabin transports	181	234	205	26.0
Multicellular transports	3	2	1	3.0
Total transports	1,205	1,260	117.5	102.5
Open cockpit fighters	1,091	424	424	25.7
Cabin fighters	26	41	37	1.9
Multicellular fighters	3	2	3	8.0
Total fighters	1,120	461	461	18.8
Total open transports	1,321	1,261	68.8	17.1
Total cabin transports	123	225	119	23.7
Total multicellular transports	41	45	24	3.3
Total fighters	1,461	549	484	16.4
Amplicons and flying boats	34	38	38	2.0
Seaplanes	37	41	41	2.4
Total commercial	1,597	1,582	1,559	101.6
Military	247	81	81	1.5
<b>Grand total</b>	<b>1,844</b>	<b>1,663</b>	<b>1,640</b>	<b>103.1</b>



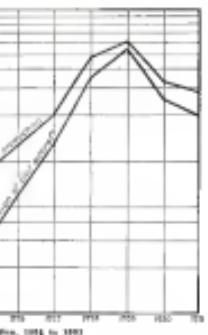
## AVIATION March, 1932

## AVIATION March, 1932

Transport production falls at a pace well below the trend rate of such planes as the past year can also be attributed a drop of 41 per cent in the average unit value of the multi-engined transports built. Open-cockpit biplanes remain about as in the past in price, as the disappearance of the open-cockpit aircraft has resulted in a transition to the light planes a large share of which used to be the normal market for the open-cockpit biplane. The open-cockpit biplane is now finding a substantial portion of its total sales as a de luxe high performance machine for wealthy sportsmen, pilots and racing drivers not tending to rise at a rate. The cabin monoplane, on the other hand, which is gradually capturing the general service business-travel market, shows a 25 per cent drop in average unit value for the year. The drop is not due to the fact that the cost of the machine included, for the average selling capacity of the single-engined cabin monoplane produced last decreased only from 4.5 in 1931 to 4.3 in 1932.

Amphibians and flying boats show a small drop in numbers but, notwithstanding the contraction at two models of unproduced size, a substantial reduction in average and in unit value. The drop is due to the substantial shortening during 1931 of production on amphibians and flying boats of from eight to twelve-passenger capacity. Sixty per cent of all the machines built were light amphibians, the others, representing not more than six passengers and an average cost not more than three.

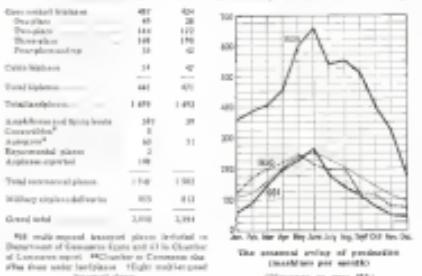
Military biplanes showed a slight improvement over 1930, as a result of 9 per cent in numbers and 20 per cent in value. For the first time since 1927 the production of aircraft of all types in the military industry's greatest year in 1926 the commercial and military branches were almost equal, the latter very slightly inferior. In 1931 the military accounted for 65 per cent of the total. Obviously, under present conditions it is more profitable for the military to buy multi-engined groups in the industry must look to carry their overhead if they are to keep their organizations alive and efficient.



### Engine production in 1932

AS INDICATED on page 155, there will be a considerable use of all types of engines in airplanes of various manufacturers. Nevertheless, a substantially natural reduction in the number of engines produced appears to have been reached. For the first time in three years the production of engines fell as well as in terms of that of planes. Allowance for the generally sharper rise of an engine, for the desirability of having rapid delivery, and the fact that engines are heavily operated, and for the effect of multi-engined planes on the total figure, that is what ought to be expected. The excess of engines in 1931 was 33 per cent, which is probably a little above the proper normal of 10 per cent. The main reason is the lack of demand caused by the lack of airplane manufacturers and of operators at the end of the year.

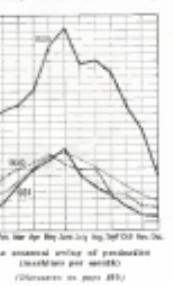
The principal changes of the year, as compared with previous records, were an increase in the production of engines for very large planes, which was of minor interest for the new-line popularity of the light plane, an increase in those of about 350 h.p., and a sharp drop in the 100-h.p. class. The changes are less notable than at first appears, the engine manufacturers in production of engines being mostly a producer of engines, though it is a producer of aircraft after a very short year. Over-production in 1930 appears to have left enough engines of that type on hand to take care of almost all demands through 1930. The 100-h.p. engine, in spite of their decline in relative popularity, still stand in second



Most recent transport planes built on illustrates of December 1931 and in Chamber of Commerce figures.

\*Includes all types of aircraft.

\*\*Includes some biplane.



\*\*Includes all types of aircraft.

\*\*Includes all types of aircraft.

\*\*Includes all types of aircraft.



#### Geographical distribution

### CLASSIFICATION of treated al- COHOL by their general type, seeking capacity, and location of the over's percentage shows considerable changes in the figures for three-seat open leprosies and three-seat closed leprosies, both of which share a very heavy shrinkage

passenger cabin machines is due to the high rate of attrition of the large group of machines of that type built in 1939 and equipped with wartime engines.

increases in readers, of course, represent new production, and are in most cases attributable to the influence of one or two models. Thus, no

#### Classification of licensed aircraft by location, type, and capacity

AVIATION  
March 1932

Classification of licensed aircraft by location and make as of Jan. 2, 1933

crease of almost 200 per cent in the number of single-seat and two-seat open monoplanes comes from the addition of several hundred Cessna, Wright, Janssen, Bell, Piper, and other light planes. That is, California the small open monoplane truly national bank. It is still possible, however, to issue small aircraft of civilian, of economic construction, or of local status or purpose.

Usually speaking, high plates now represent about 10 per cent of the total number of licenses outstanding, as against only 2 per cent a year ago. This year, however, there should drop in the total of high plates, as the number of those with 15 or more rings, taking all classes together, is off from 90 to 65.

Plant spacings have not been laid out as precisely as of late years convertible from landings. Analysis of the data shows that spacings are greater, with a total of 148. Flying boats have suffered a drastic reduction, down a total of 48 to 26 private owners and all these are pilots and where there are relatively low areas of great wealth.

It is suggested that in order to obtain the separate figures for the separate states, it is necessary to reckon in the effect of transport localities. Most of the planes being

During the past year, ownership is very highly concentrated. New York, New Jersey, and Pennsylvania claim about 60 per cent of the nation's total, and more than 90 per cent are owned east of the Mississippi.

Local irremediables or distributions are much less than in the past. This is due to the fact that the other governments made for their base, but the Nigerian base is below the **make and distribution**

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Travel Air seemed, but if all the Curtiss-Wright products be grouped together their total sales to 1715, which is well beyond any competition. Standard has dropped from 8th place in the ranking to 10th place in 1928.

The most striking feature of the history of the nation by states of ownership is the absence of national distribution except in a very few instances. It is still true that local guilds in a local product, and the actual or supposed advantages of having the factory near at hand for service work, play a very big part in determining sites. This tendency to concentrate most of the sites within a few hundred miles of the factory seems to be much more marked for open machines than for the cage type.

Another way of getting at the same information is through an examination of the number of states in which a particular snake has made any sort of showing at all. On that basis *Travel All* comes closest to showing a truly

Licenses and identifications  
recently granted by states.

quarterly for 1931

	Ans.	AST	Prog.	Res.	
	to	to	to	to	
	May	Pass	Rank	Due	Total
Answers	7	29	25	38	47
Answers corr. & Explan.	3	1	1	8	23

Ammonium Oxide-Ethanol	10	9	13	8	41
Acetylacetone, 80%	5	6	3	1	8
Benzyl Alcohol-Ethanol	6	4	3	1	20
Barbit.	7	21	38	38	99

existing distributions, having at least 1 per cent of the total registrations in every state except South Carolina, and at least 3 per cent in every state but

Excluding the wartime engine from consideration, the Curtiss-Wright had all other makes on par with, a total of 1,503. The J-5 Whirlwind came in at 672 of that total, and the various forms of J-5 Whirlwind 764. Pratt & Whitney is next in line with 665, then Pratt & Whitney with 256.

**Current production by makers**

THE title of *beemers* and *elephantmen* is often used on new machines in the classic approach that can be offered to a calculation of production by makers.

The table of distribution of miles of engines by user, that has been included in the statistical issues in past years is omitted this time for want of space. It has, however, been prepared, so that it is possible to give the general conclusion which can be drawn from it.

The most striking feature is the rapid disappearance of the wartime engines. They are going out at an accelerating rate. Two years ago there were 2,900 surplus engines in the U.S. This year there were 2,668, and the prophecy was made that the number would have dropped below 2,000 by the end of 1932. It actually went well below that.

degree is half the time asperated, for the present tabulation shows it reduced to 1.2. It seems likely now that the wartime engines and particularly the

The figures on engines used in new planes are not so good a representation of current production as in the case of the planes themselves. Apart from the fact that there is a much larger time lag between the completion of an engine and its appearance on the lot of housed aircraft, a certain number of new machines are sold without engines. The figures for the production of planes in 1938, given previously, were obtained with Wright H-26 engines, which have been out of production for two years. Still the figures offer a fair guide to the production of non-military engines, and they are the best guide that is available for prediction.

Only 56 new machines or 3.5 per cent of the total production, were equipped with wartime engines. For the last quarter the proportion was ten times 2 per cent.

**Average life expectancy**  
**T**HE distribution of licensed aeroplanes by age considers the material factor in determining the average length of life. This is the third year in which such a tabulation has been made and we now have the data for a reasonably accurate prediction of the rate at which machines of various types will disappear. At the end of 1929, for example, there were 1,382 machines of 1929 manufacture, 1610 machines of 1928 manufacture, 1410 machines of 1927 manufacture, and so on. The records in the event of a pile that total dropped to 1,036, and now it has fallen off to 1,382.

To get a real life expectancy curve, however, the cost should be broken down more closely by types. Obviously, there is no reason to suppose that the life of a multi-engined transport machine will be the same as that of a light four-seater.

A group of well-known makers in the low-priced open cockpit class, all of which had an aim now a very large percentage, was invited to compete in this group, and the group that was upon the Department of Commerce books at the end of 1929, the end of 1930 and the end of 1931 was determined for each year's production. In 1929, the group was 1,140, and in 1930 it was 1,143, and in 1931 it was 1,147. During 1930 it dropped to 1,147, and during the past year it has fallen off to 1,146. Similar comparisons have been made for all the other plane manufacturers, and for

other groups and types.

For the medium-priced open cockpit type, it appears that about 4 per cent of the machines are eliminated before the end of the year in which they are produced, and about 7 per cent during the following year. These figures, of course, represent loss by resale. In the second year following that of production about 12 per cent of the remaining planes disappear, and so, in consideration

#### Licensed airplanes by age and make

up, in the ninth year of 35s, the charges are 25, 35 and 40. For a plan of 35s there is to be a larger expense for the compensation of the pensioner for the first six years and for the last three years are 4, 5, 30, 12, 15, and 18. This makes up to the present responsible compensation. "Orphans" and their contractors have

which move rapidly. To determine the mean of the figure, count at 39 points per span, and 50 for the middle machine. The mean of the first and second machines is the mean of the whale, as the figure is divided in two.



ment were operating two years ago, have now almost disappeared. Of the 291 landplanes of ten-passenger capacity or larger which are now licensed, the dealers and flying services held only fourteen, while the transport companies have just three-quarters of the total number.

The open plane is still more dangerous, using the machines owned by flying

clubs, making up 32 per cent of the total, including 13 per cent of light planes.

Analysis of the tables of age, type, and ownership shows a general picture with the general table on page 135. It has already been noted that the transport companies have done very little buying, but that non-aeronautical corporations of other types, on the other

hand, have made relatively heavier purchases in 1930 and 1931 than in 1928. Most strikingly apparent of all, however, is the dependence of the flying services on old equipment. Out of the 1,735 machines in that group, only 37 per cent were manufactured in 1928 or earlier. In 1928, 11 per cent of the old machines were bought by dealers to get the number back in the last two years that are down on one for flying service work; it comes down to about 380 out of 1,338, or 28 per cent. About 75 per cent of the remainder of machines now owned by flying services for their own use are of 1928 manufacture.

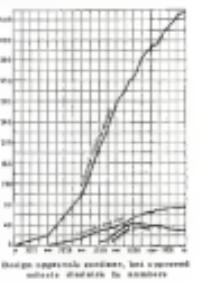
### Aircraft, pilots, and mechanics, as of Jan. 1, 1932

State	Aircraft			Pilots		
	Licensed	Unlicensed	Total	Private	Commercial	Total
Alabama	16	16	32	12,187	36	12,223
Arizona	45	19	64	1,019	34	1,053
Arkansas	12	12	24	10,610	4	10,614
California	920	100	1,020	1,740	1,023	2,763
Colorado	46	19	65	12,280	82	12,362
Connecticut	114	11	125	16,495	60	17,155
Delaware	21	21	42	1,070	11	1,181
District of Columbia	81	81	162	3,719	364	4,083
Florida	121	65	186	11,781	149	12,930
Georgia	39	30	69	74,127	13	69,140
Idaho	38	13	51	20,225	21	20,246
Illinois	311	250	561	14,676	100	15,676
Indiana	104	104	208	16,363	47	16,810
Iowa	147	79	226	16,363	47	16,810
Kansas	103	104	207	11,971	138	12,109
Louisiana	20	21	41	42,941	47	43,988
Louisiana	88	87	175	48,775	32	51,147
Maine	44	19	63	16,126	2	16,128
Maryland	11	11	22	1,000	1	1,001
Massachusetts	283	28	311	26,019	141	26,160
Michigan	343	141	484	11,840	324	12,164
Minnesota	114	114	228	22,566	123	22,689
Mississippi	24	16	40	12,785	22	12,807
Missouri	391	176	567	16,189	243	16,432
Montana	31	20	51	18,197	34	18,231
Nebraska	112	71	183	9,790	103	10,683
Nevada	12	12	24	10,200	11	10,211
New Hampshire	23	8	31	28,246	11	28,257
New Jersey	273	93	366	18,654	91	19,665
New Mexico	39	2	41	10,107	33	10,140
New York	912	71	983	57,937	321	61,258
North Carolina	31	30	61	42,250	30	42,280
North Dakota	42	42	84	11,780	13	11,893
Ohio	439	123	562	15,446	120	16,546
Oklahoma	191	14	205	10,695	180	11,875
Oregon	31	28	59	21,481	47	21,928
Pennsylvania	632	104	736	21,838	203	23,841
Rhode Island	27	1	28	10,964	17	10,981
Rhode Island	18	18	36	10,964	18	10,982
Rhode Island	34	9	43	12,036	36	12,172
Tennessee	105	34	139	11,512	98	12,400
Texas	127	127	254	20,400	127	20,527
Texas	51	51	102	11,851	62	12,373
Texas	28	9	37	17,112	38	17,150
Texas	59	35	94	33,661	93	34,656
Washington	159	80	239	13,012	147	14,489
West Virginia	30	17	47	15,565	7	15,642
Wisconsin	182	9	191	14,424	133	15,557
Wyoming	20	12	32	9,191	25	9,216
Total	3,243	922	4,165	16,681	1,216	18,896
Unlicensed planes only	3,243	922	4,165	16,681	1,216	18,896
Excluding 44 industrial planes	3,243	922	4,165	16,681	1,216	18,896

### Pilots and their distribution

The most notable change in the record of pilots on the past year, aside from an increase of 16 per cent in their total numbers, is a further increase in the proportion of private pilots. Two years ago they were only 43 per cent of the total. Last year they were 49. Now they are 53. The proportion of the licensed to the unlicensed group has increased, following from 14 per cent at the beginning of 1928 to 9 per cent this year. Obviously pilots are tending to divide into two widely separated groups. One is made up of those who expect to fly only for pleasure, and who may never learn to like anything more than a propeller. The other is made up of those who expect to make flying a profession and who go straight through in their transport qualification as quickly as possible.

The greatest total number of pilots are employed in corporations which do not count among any other two areas contained on any other than three except New York. Even if the effect of the large number of Army and Navy pilots located in California be eliminated, it appears that out of every 3,000 civilian citizens of that state holds a license as some grade.



Licensee aeronauts, 1928-1932, in thousands

### AVIATION March, 1932

### AVIATION March, 1932



## Foreign trade

### "What has America to do with abroad?"

### The export trade of the American aircraft industry, which has steadily

shown signs of becoming as important, during 1931, but the full force of the world-wide economic depression and dropped to the position which it held two years ago. The number of aircraft produced in the United States in 1930 was 1,735, and the number of aircraft produced in 1931 was 1,216, or 28 per cent less than in 1929. Considering separately the drop in 1930 was from 16 per cent expected in 1929 to 5 per cent that year, and the drop in 1931 was from 10 per cent in 1930 to 12 per cent in 1931.

The change, although striking, is not striking.

The sharp decrease, however, has occurred in the nature of the exports. Aircraft, which in 1930 formed 35 per cent, this year made up only slightly more than a third of the total exports. Aircraft exports, however, are not the only field for which the 1931 total, compared with the 1929 total, reflected the effect of the previous year. Round the world, distance and other recent flights, advanced the efficiency of American engines, and the demand for them in the States, Netherlands and other countries were in the market for such products. The use of these engines were desired for use in transport and military planes in addition to an increase in the number of aircraft. This was accompanied with a decrease of about a tenth in average unit value of the engines produced in this country. The average unit value of the planes exported, mainly transports and military planes, was the only group which showed a slight decrease, attributable largely to the price reductions typical of the past year.

### Europe again our best customer

Among the results of a consideration of the figures on the export trade of the United States of America for the past year, the conclusion of Elanpe is that the condition of Europe is the largest single purchaser of American aircraft products for the first time since 1926. Elanpe retains second place on the list of

importers, but South America, last year at the top of the list, has dropped to third place. Germany and Russia and Russia's chief competitor, France, have had their effects. The purchase of South American products was reduced 31 per cent. It includes only large planes, designed for Chile, and is made up almost entirely of engines and parts.

### Aeronautical exports

#### 1931-1932

#### 1930-1931

#### 1929-1930

#### 1928-1929

#### 1927-1928

#### 1926-1927

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#### 1900-1901

#### 1899-1900

#### 1898-1899









## Foreign activities

How do Europe and America compare?

A COMPARISON of aeronautical expenditures has been made in tabulated form, but it requires some brief explanation. There are many gaps which could not be filled even after study of all the records available in this country. It is impossible to secure directly comparable figures for paradi-

lating for the various countries. The definition of the term "airforce" varies from place to place, still more variable is the determination of what should be included within the appropriations for civil aviation. In France, for instance, a number of other countries to a lesser extent, there are government services which are not civil and military functions and which can not be split up between the two.

In general, the attempt has been to exclude charges for the regulation of airmail, for airway development, and for research bearing exclusively on civil aviation. All of these, however, the states have been set as nearly as possible in parallel form with those of the budget of the Aeronautics Bureau of the Department of Commerce. It is not always possible to make such a separation, however, and in some cases memorandum figures for civil and military expenditures are included in civil government, which are prohibited by treaty. In

having any military air force, and which must, therefore, charge all their aeronautical expenditures to the civil aviation. In Germany a large amount of miscellaneous research, developmental, and administrative work would be carried on in any other country by the Army or Navy has to go down as civil aviation.

The highest per capita appropriations for civil aviation is undoubtedly that of Canada. Taking into account the probable deficit on the air mail contracts, the total governmental outlay there amounts to 55 cents a year for every person in the Dominion. The figures for the United States, including the air mail deficit, is 29 cents. Belgium spends 30 cents per capita largely on airway development in the Atlantic colonies, while no other European state goes in high as 29.

The spending on per capita civil aviation in the United States is quite different. On that basis, both Canada and the United States, each with a figure of just over \$1, are well down the list—but before France with \$1.30, and Great Britain with \$2.23.

To obtain the accurate comparison among the various countries in the way of air transport operation, the entries at the bottom of the page have been drawn.

With the closest schedules to the transport companies and the total expenditures on civil aeronautics have been plotted. The figures do not exactly correspond to those in the table in some cases, as a certain proportion of the aeronautical expenses of non-aeronautical departments and particularly those for meteorological services, airway surveys, etc., have been omitted. In the case of the United States the figure plotted as the total governmental outlay on civil aviation outside the appropriations of the Department of Commerce, the Post Office Department's deficit in air mail, and the Weather Bureau's airmail work.

It appears that the American government is spending on the promotion of civil flying about a third more than France, Germany, and Great Britain together. The American government, however, gets more for its money than do those of most European countries. The air mail outlays shown in air transport under the American flag was some three and a half times the combined

total for the three countries just mentioned. The American passenger mileage is three times the aggregate passenger-miles of the other three. These are fair worth bearing in mind for the benefit of the individual, occasionally well educated, who wants to know why aeronautical developments in America lag in the behind those in Europe.

In the lower curve, left, does not only the total civil aviation expenditure are given in terms of dollars per equivalent passenger-mile of traffic, taking a total of 100 percent of all air mail and non-passenger miles, as the traffic actually handled, but that for which capacity is provided, plus a third in its calculation—so that it appears that the government is spending 30 cents per passenger-mile on civil aviation when the passenger fare is only

## Passenger traffic in passenger-miles

(Thousands omitted)



Passenger mileage (year by year)

## Annual airplane mileage in air transport

(Thousands omitted)

United States

Canada

France

Germany

Great Britain

Italy

Norway

Sweden

United States



E D I T O R I A L S

## AVIATION

BOSTONIANA 77: 77-100, 1993.

## An aviation platform

### Aldehydes from Polymer

**W**E continue beneath the presentation of a progress. A great deal has been and in the past three years goes about various agencies, especially various departments of the government, ought to do for the aerofoil industry. All that is very important, but it seems to us to be more important that the industry find out what it can do for itself, and proceed accordingly. The platform, at which *we* are the third installation with still more to come, is a listing of a few of the most conspicuous and odd of the parallel measures of encouragement from without.

### Manufacturing costs

**6. Stop taking a loss.** Even after two years of depression and of forecasts that have gone sadly astray, there are a few fundamentals of economics and management to which we can cling. One of these is that the man who persists in selling his product for less than it costs to make, is apt to have success only if the segments in favor of such a course may be, ultimately headed for a re-shipment. Unless it is very clear that a return for the latter is in sight, it is better that no business be done at all than that it be done at a loss.

Three years ago, there was some justification for arbitrarily setting very low prices on airplanes in order that the public might be persuaded to acquire them with the product. The time for that has passed. Price is not such a factor in selling planes that there is any real group of customers waiting to cash forward with escrowed check customers if a few hundred dollars can be shaved off from what they have to pay. Experience has taught us that there are too many other factors that play a large part in conditioning the market. To continue price-cutting is to embark the industry on a policy of mutual extermination without any compensating return. It may be necessary, under existing conditions, to provide each item of overhead as not and intrinsic as figuring costs. It is disadvantageous, however, that price ought never to be set at less than 10 per cent over the cost of manufacture, including executive salaries, the upkeep of the plant, and the maintenance of sales and other departments outside the factory doors. Unless that can be realized it is better

to build places only on order for people who know what they want and are willing to pay what it costs

While all these precepts have been put in terms of rationed practices, they apply with equal force to the rate of military planes. Building regardless of cost in order to get a contract on a competitive basis, endowed with the not unusual willingness of the servants to take advantage of the lowest prices that can possibly be obtained, has been the curse of the aircraft industry at times in this period of its history. As a general rule it is better to let business go and shut down a factory than to keep it running by getting orders on such terms.

5. **Stop price increases on used planes.** A particular form of price cutting, and one of the most aggravating forms, is the offering of exorbitant allowances on used equipment, or the making of lengthy break concessions on the terms and extent of payment for a newly-purchased plane. If there is one thing which can do the aircraft industry more harm than general competitive price cutting among manufacturers, it is the hidden and visible forms of price-cutting which result from liberal and excessive allowances on used planes—so far as that matter, as anything else, from outside sources to grab planes, that the would-be purchaser may possess. The aeronautical industry has been through this repeatedly, and has struggled with it constantly, with little measure of success. The manufacturers of airplanes will have to take the matter in hand promptly and police their own field, if they expect these advertised prices on the product to command any respect. The selling of airplanes is a necessary part of a great industry. If the industry is to survive on a sound footing, it must not allow its selling to drop into a process of haggling like that which attends upon the purchase of a rug from an Arab merchant in an African bazaar.

*Answers remaining Name of the plenum to be convened  
and month*

*Other appointments or mandates to use diplomatic  
and more flexible forms established  
Cooperation in foreign markets  
Stock control of strategic raw materials  
Present a united front to military government officials  
Adopt open industry policy on the consideration  
of civil design*

## NEWS OF THE MONTH

### The Far East

While delegations to the December Conference at Geneva discuss the probability of halting the strength of air forces, the air arm is held under the spotlight of world attention in the Far East. Missing of the Japanese forces in the Shanghai region has been the group of 60 planes from the aircraft carrier *Kaga*, and at the three with which the Japanese army is equipped. China is said to have a civil air fleet air force including Vought Corsair, Douglas bombers, and Armstrong Whitworth fighters, and of these aircraft at Ningkow and Canton. China also has a large group

of steel, higher temperatures, relatively coarse size of ore, or because of the use of more primitive mining methods. It includes 148 Vulture. Vulture, transparent, purchased twelve years ago, and is part well contained in the suspended crater. Photographic at Chinese plants as the war was also also Avon 500 E's and Beehive 168, both of 1938 vintage. Though eighteen Chinese plants were soon defending their airfields west of Shanghai and another was shot down in a duel in which its opponent also fell, Japanese aerial munitions have been for the most part untried except by antiaircraft guns which accounted for one surviving plane. Aboard Shokaku

gated the internationalization of air aviation as outlined in "An Amended Standard in the 'Rhine' Test" in February, 1928, and, in addition, the publication of an air navigation law, by the establishment of the private ownership of planes of large size. They also called for an international police force to regulate the rapid growth of private heavy bombers and fighters. Finally, they suggested as a successor to early Wright free incorporation in affiliated air forces. But French delegates possessed some of the strongest air units in the world had nothing to do with making of the new international air power.

lost suffered heavy damage on the black stone and headquarter. Before returning to the aerial canvas. One of these, the Swallows, was part of "command" shortly afterward by bombing targets of the Japanese, but was put out of commission by a direct hit. It was replaced by another, which was completed by other men. Five were shot down at 100, 150 yards east of Honolulu, and each sprang its plane from the field as well as from the

#### "United air force" again

While executives of the several keep an eye on Hunan and Shanghai and

## Calendar

## Airship scandal?

Interest in recent writing naturally has focused around Congressional hearings on charges by two former *Ziegfeld Follies* performers that corporate employers often engaged in defective medical and workmen's compensation plans and that had been passed at the construction of the Air Force. The charges were vigorously denied, of course, by Macmillan and *Ziegfeld Follies* officials. The Senate Committee on the House Naval Construction Appropriations bill to be introduced was expected to include the charges and made an investigation of the Lakehurst plant in company with Capt. Col. G. C. McDonald, one of the army's critics of the construction, have been announced.

It came out in the hearings that Mr. Slavy is willing to tell the Los Angeles fire department all, though probably not all the details, without any compensation.

completed in January, 1932, has been commissed. A number of inquiries have been received, including one from Harry L. Smith, of the Los Angeles, Calif., who asked for the services. The Goodyear-Zeppelin Corporation is considering making an offer. It has been suggested that proceeds from the sale be devoted to the additional expense of enlarging the new wings in a cost of \$7,500,000. The new wings will be 100 ft. long, 10 ft. wide, and 10 ft. high. The new Goodyear-Zeppelin Corporation, which has a capacity of 1,810, which is to have a capacity of 2,200 passengers.

While its merits were being debated, the Akron weathered successfully a severe storm which struck the airship in the course of its trans-oceanic flight, and with certain steps of the weather forecast. While passing down the east coast to engage in the first crossing of Florida, the airship encountered low fog, sleet, snow, and rain, while pier 1 at a stormy port. During the night the airship landed in the dark parts of the fog to the depth of 6 in., and a coat of ice formed on top of the hull. No difficulty nor apparent hazard resulted. Feature of the trip was the successful crossing to the airship-station, Pauatah, off the Venezuelan coast. The next step is preparation for the return flight. The first task was the installation of four special Curtis fighters on the airship's hull baggage. These machines will need no landing gear when operating with the airship, and performance should be comparable to that of a spirit of fastness at size and weight.

Now scripted as a trial and test craft, the Akron is about to have a new commanding officer. To round out his naval experience, Leroy Conard, Capt. E. H. Mandelblit, survivor of the Shenandoah disaster and for six years the Navy's leading dirigible skipper, is to be next to sit in a service vessel. Conard, who has been in the service for 20 years, is a native of Los Angeles, Calif., and survived him.

The introduction of airships into civil air transport on trans-oceanic passenger and mail lines would become possible under bills introduced into the House and Senate by Rep. John W. McCormack of Boston and Sen. McMath of Alabama. Like the Cramer and McMath measure introduced last winter, both provide for mail contracts on fairly liberal terms and for construction loans at low interest rates, like those by which the federal government supports the construction of new merchant vessels.

### Air space ownership restricted

The senator immediately withdrew, however, and the bill was referred to the Senate Committee on Interstate and Foreign Commerce, which has been investigating the airship. The bill, as it stands, is based largely upon the Aviation Law, having passed by the Commerce Committee in the Senate, and the Senate version of the bill is to give an exclusive the monopoly of the work of the representatives, special traders and insurance companies. The bill also contains certain legal dispositions.

The right of a landowner to the air space above his property has again been argued in a re-hearing of the famous case of *Southern v. Curtis Airports Corporation*. Owners of property adjacent to the airport and the Commerce Committee have directed Capt. E. H. Mandelblit, of the Bureau of Aircraft Electronics, to the defense of the claimants. The court, however, has ruled that the airship is a public utility, and that the claimants have no right to sue and win.

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COMMENORATING A FAMOUS FLIGHT

This monument to the trans-oceanic flight of a number of British aviators was dedicated early in January at Belmop, Malacca, on the first anniversary of the return from that flight.

United States Circuit Court of Appeals upholds the injunction, but dismisses the grounds on which it had originally been based. The court held that the injunction in a single instance constituted a trespass, but allows that repeated passage might create an trespassory nuisance. Whether or not it did would depend on the particular circumstances of the case, the decision is very strengthening to aeronautical interests.

The final draft of a uniform aviation code for adoption by the states, under consideration for some time by the Association Law Committee of the American Bar Association, was presented yesterday in Astoria, Oregon, (see page 156). The code, which defines the ownership of air space above privately-owned property as well as liability of airmen for damages to property, will be submitted to the association at its annual meeting in Washington this fall. Upon acceptance, will have been taken to persuade states to amend their statutes in conformity with the proposed code.

### International Bulletin 7-A

Legal standardization on an international scale will be among the deliberations of the International Air Navigation Conference of Stockholm, Sweden, in December of this year. The Conference on Commercial Aviation, signed at the Sixth International Conference of American States in 1928 and so far ratified by five countries, including the United States, will form the basis for the study.

Some ten years of debate by the International Commission for Air Navigation have finally resulted in the formulation of regulations governing standard design and the issuance of certificates of airworthiness. Some 150 changes in many details, they are to be put into effect in the 26 countries parties to the convention of 1928. The regulations generally resemble French practice.

Concurrent with announcement of the regulations, the first British flying boat are details of the anticipated Dutch grand design for use on the Amsterdam-Batavia route. At least twice the size of the Do X, it will be a monoplane of light metal and construction, with the engines and most of the remaining features installed in the wings. The 100 ft. span of four Pratt & Whitney engines will give it a speed of about 140 mph., and with a normal passenger load of 200 persons and maximum of freight range of 2,300 miles. It is, at present, a paper airplane. P. Koolhaas, the Dutch designer, designs since 1912, guides the project.

The engines of the Koolhaas R100 were the inspiration of several years' research on "steam-rolling." Past experiments of several months duration with day

Trophy names, will be flown over a 16-mile triangular course at Inciralti. There will be more stress on international events than in the past, less attention paid to man the A.T.C. holding record.

Another important novelty will be the absence of sex discrimination, illustrating the women pilots have been restricted to races for women only. As in 1931, a number of women will bring their husbands. Cliff Henderson's decision to dismiss feminine rules and programs.

Changes are to be made in this year's Klieg's Cup race in England. It will be run on two days, the first day's event a trial heat to qualify a maximum of 40 soloists to compete in the main race. The winner will be a force four year, one-cylinder airplane capable of a speed of 110 m.p.h. at nose and one pilot with at least 100 solo hours will be eligible. The course for the first day will be 750 miles long, that for the final race 500 miles.

Charles Chamberlin recently added a high altitude flight to his exploits with his Packard-driven-powered Lockheed, and made a effective answer to critics of the plane who have alleged that the type would not run at all at high altitude, since the engine would not be able to develop sufficient pressure power to be sufficient to fire the charge in the cylinder. Chamberlin reached an altitude slightly in excess of 23,000 ft., probably a record for a compression-ignition engine plane. So far from the engine having inferior power at pressure altitude, he found that the altitude had to be held slightly at the high altitude to hold a constant rpm.

While on the West Coast during a recent trans-continental survey trip for the Texas Company, Frank Hawks, the famous aviator, and his wife, Anne Collier and Chamberlin, won the first two in 12 hours and 44 minutes (2,200 miles, 164 m.p.h.). Hawks used his well-known Travel Air 5. Though his plane had to be repaired for the round trip, Hawks failed by 6 minutes to break the six-day record to Vancouver held by James E. Worrell.

**Pilots out, A.L.P.A. in.**

The first strike, or lockout, or combination of both in the United States has occurred. Pilots and executives of Crusty Airlines failed to agree over a wage reduction and the former, members of the Air Line Pilots' Association, on Feb. 9 ceased being employees of the company. All 120 pilots, excepted, and a new pilot, Irene Wright, collected. Unusual significance was attached to the episode because of its lack of precedent in American labor circles. The company had sought to change pilot salaries from a fixed to an hourly rate. The company officials said the change would amount to a 15 per cent wage reduction over a period of a

### Air races emancipate women

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year. The pilots said it would be 50 per cent. The Air Line Pilots' Association has called round its 200 members, with all the preparations traditionally associated with labor actions at war. All members who have positions are to be assessed, that strike benefits may be paid. Any pilot taking employment with another airline will be given a release notice to the effect that his services are to be held liable by the Association. Century's operations are to be halted, both on the ground and in the air. The struggle will, unless a compromise is very promptly reached, go far to determine the fate of the 700 Air Line members, whether it is to be a virginity-wrecker with interests largely social or an extremely powerful and aggressive factor in determining the operating and personnel policies of the air transport.

Lodging class carries another air in the air transport field by announcing intention to step up its hourly service between New York and Washington to a half-hourly frequency in April. Two-hour round trips daily in the plan begin 10 days from the present time. The single fare will be 50 cents, with stop \$2.50 between the two cities, the flying time 80 minutes. Canadian Pilots' for equipment. Thus Lodging is added to the list of operators no longer considering multiple engine aircraft for passenger service.

Effective Jan. 16, Pan American will use new low fares for the New York-Washington service. Formerly \$1.50, the through fare now is \$1.00, the round trip \$1.50 instead of \$2. The base fare is now down to 5 cents a mile. Object, in attract passengers during the winter months. Eastern Air Transport, Lodging's competitor, has announced no corresponding change, but maintains the \$1.25 one-way rate.

Manufacturers have announced the scope of the first railroad-supported service, a nonstop flight to a 100-airport field, roads generally to be both motor vehicles and seaplanes.

Early selection of several railroads to the service by the Illinois Commerce Commission at certificates of convenience and necessity to three air transport companies to start in April some cities coincided with the statement you later received. The commission decided that since the type of transportation afforded by the airlines was not rendered by the railroads there was no objectionable conflict.

#### All-Red Cape-Cairo complete

Chief among new services inaugurated is the Cairo-Cape Town run of Imperial Airways. The first through flight started from Croydon Jan. 28. The new part of the Empire route consists of the operations of Air Transport and Cape Town, the Cape-Sinai section having been opened on Feb. 28, 1931. The flight from London to Cape Town, al-



WASP IN EUROPE

The new Fokker F.III originally transports in use on S.S. Wasp. American-British armament and unit service are seen with Fokker F.III engine.

most 8,500 miles, consumes twelve days. Passengers are large (for Jan. 20, 2000), particularly in the British and Belgian sections.

Arranging Soltész Argentino, and between Ceres and Klerken. Short Caledonia flight hours between that port and Narrows, de Havilland Heron routes between Nairobi and the Cape. Imperial Airways has also taken delivery of a Douglas, later to be used in flights of Hadley Page Four-engined biplane transports of the Bristol type. Four are in service between London and Paris and the balance are operated between Cairo and the Nile East, following the Suez Canal. The African section of the African service. The continental Herons are fitted to accommodate 26 passengers, the others but eighties, to provide greater comfort in the winter climate.

#### New Pan American service

New services include the 36-hour air-mail service between New York and Paris started by Pan American Airways at new low contribution rates (10¢ per New York-Moscow). The Atlantic route is to be handled by Pan American, and the Pacific by Pan American, from San Francisco to Manila, and from Manila to Tokyo.

T. A. C. has moved its operations headquarters from Panama, and its mail-purchasing department from Cleveland, to the larger at the Denver City Airport. The first flight of the new equipment, Pan American Airways, between Detroit and Cleveland April 1. It has followed up its experimental state-continental airway work of last summer by negotiations with foreign governments for leases on valuable landing places along the route.

Trans-Canada Air Lines has shifted its Miami terminal from the Pan American airport on Feb. 28, 1931. The Miami Municipal Airport, Robertson Airfield's service between St. Louis and New

Orleans has been discontinued. Century routes, but it has been reduced to 1000 miles between New Orleans cities within six months.

United Airlines and Western Air Express have opened up their combined Los Angeles-New York passenger service by two hours, setting planes on the new routes and the trip between the two cities 36 hours and 40 minutes. The single section of the flight is between Lake City and Irene City.

#### Eastern Canaries hushed

Further continuation in passenger service is to be made on planes of the Eastern Air Transport from the installation of a modifier for engines reported to reduce noise by 20 per cent. (Cost of improvement not stated). A 1000-mile section of the route, including the diameter of the old type routes, seems to give the aircraft gain a whirling motion, so using up their energy before release into the sky. De-signed and developed under the direction of the British aircraft engineer, Captain (now Sir) George White, of the Royal Air Force, and recent maintenance work in Australia, it has been in use for three months in several of the company's康特拉, and will soon be standard equipment.

Varney Speed Lines is reported to be arranging for a Berlin to the Far East route via the Pan American Airways. The first flight of the new equipment, Pan American Airways, between Detroit and Cleveland April 1. It has followed up its experimental state-continental airway work of last summer by negotiations with foreign governments for leases on valuable landing places along the route.

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were held in January between French and German representatives regarding consideration of interests in developing Europe-South America services.

All employees of United Air Transport are to be held in group life insurance plan recently taken out by the company. Each pilot is insured for \$5,000, each male for \$3,000.

Express continues to receive extra attention. T.W.A. has arranged for the air-mail service started in October in cooperation with the Army to be continued by cable package as an passenger. Pictures now are removed at all Greyhound stations and forwarded through consolidated schedules by air and bus. Century in January began filing an express contract with the Chicago Mid-Grid Company, a management of package delivery to be done by express. The service will be extended to include other key mail distributing points. A promotion and advertising campaign is to be started soon by the Shirley Hills print Agency and the team with which it is connected to increase patronage of the service under the new lines announced every monthly issue.

Paul Goldfarbman announces that the work of "lubricating" the airways for the transport companies, undertaken about two years ago by Aeromarine Radio, Inc., has been completed. Aeromarine has been installed in about 80 cities, and is predominantly of the radiotelephone type.

Central-Pacific had its first major accident on Jan. 29 when a tri-engined Stevens crashed as a consequence of the engine failure of one of the two in the rear. The aircraft, not long after it had taken off from that point, "Wander" conditions were extremely bad, and it appeared the machine had struck the ground while the pilot was attempting to go back to Sacramento. Century-Pacific has already started its new line to Tucson to El Paso, is reported likely to go through to St. Louis soon. The Arizona Railroad Company has postponed buying the line's application for new certificates of convenience and probably will March.

#### Lawmakers think about parachutes

A survey is to be undertaken in view of the recently numbered 121-cals field array between Boston and Albany by way of Springfield, Mass. American Airways received the mail contract for the route among the excise tax granted and probably will March.

#### Parachutes think about parachutes

The Century crash revived agitation for some form of legislation of parachutes in passenger traffic. However, there is little in the circumstances of that tragedy to suggest that parachutes could or would have been used. Some excitement has been aroused by the appearance of an article in *Forbes* by a parachute enthusiast, pointing the alleged use of the device in the bird strike. A parachute-expecting bill was introduced in the New York State legislature in January. Early in February a bill was introduced in Congress by Congressman Coffey of New York to require parachutes for all passengers in all intercity transport flying.

The first bill to be introduced in the present session of Congress regarding air mail would fix \$1 per mile instead of \$1.25 as the maximum compensation for agents, and would limit the route established to those areas of least population. It was introduced by Representative H. R. Jackson of Washington, D. C., in January. It properly superceded a proposal considered for the public good.

Following growing sentiment in favor of state development of intra-state airways, Michigan has taken over the state-owned Detroit-Canton airway. The state's only intra-state airway and most used, Detroit-Canton Airlines and the Illinois State Aeromarine Commission have prepared elaborate plans for a state airways system when routes become available.

Along with the interest in development of intra-state airways, the idea of state-owned airports, the Illinois State Aeromarine Commission has decided that after Feb. 15 airports within the state could not be operated without a license from that body. The first demand issued by the St. Louis Municipal Airport Commission includes the recommendation that New Jersey ports be licensed. That state includes two of the leading civil fields in the East, Central Airport at Camden and Newark Municipal Airport. The latter is to be a terminal growth point for the east coast passenger traffic, according in 1931 to 90,000, as against 22,356 the year before.

Representative La Guardia of New York, aviation enthusiast, has asked the House to provide a public terminal airport, Governor's Island, New York. Senator Alben Barkley of Kentucky has also introduced a bill to establish a terminal growth point in the state, and the first passenger terminal, according in 1931 to 90,000, as against 22,356 the year before.

The expansive building and all the expense of the new New Haven Municipal Airport may not be an economic one, but it is, but, in fact, an engineer's report submitted the week to date had been seriously wrong. A newly recruited expert believes that the end of it will dry out with the passage



ITALY'S DOX.

The Italian model of the Do X, the general of the type 8000 to Dardanelles, consists of two cockpits and the main seats have been considerably increased so as to accommodate the first model, now in the country.



## FLYING EQUIPMENT

## A new

## Stinson Junior

RECENTLY announced was the production of a new model of the Stinson Junior, by the Stinson Aircraft Corporation of Wayne, Mich. Although following the general lines laid down by the earlier models, the new machine incorporates many changes which make for increased speed, stability and passenger comfort.

The principal variation is in the design of a new type of landing gear, in which only mainwheel, wheels and shock absorber units are carried on the outward end of small wing strut projecting from the nose undercarriage fairing. The wing strut arms extend inward from the ends of the wing struts. The overall drag of the undercarriage has been reduced by these changes. The external lines have been changed somewhat, particularly in the shape of the landing tips, which have rounded off considerably more than in previous models. A new V-type windshield also adds to the classifying, and affords improved vision for the pilot.

Passenger accommodations have been improved by increasing the interior dimensions of the cabin 4 in. in width and 1 in. in height. Standard practice has been followed in the construction and arrangement of seats and fittings. A layer of insulating wool lets him look out the window to reduce noise, and adjustable safety glass windows provided. Heating is provided for winter flying.

Standard equipment for the model B includes a 215-hp Lycoming engine, rubber-tipped, flexible electric starters, Hirsch Standard propeller, mag type

engine cooling, Passer instruments, securer wheels with Tandem roller bearings and self-energizing brakes, and full navigation and cabin lighting equipment, including a 32-soft airtight storage battery.

A redesigned  
Privateer

A NEWLY engineered Privateer of a somewhat familiar form, but distinguished by a more modernized appearance from earlier models in some emerging flight test at the plant of Aeromarine at Roosevelt Field, L. I. Structurally the hull resembles land plane

rather than conventional flying boat practice. The fuselage is of welded steel tubing and is designed to carry all stresses without assistance from bulk or ribs plating. The nose, therefore, is a single unit, only 10 per cent water-tightened, and is reinforced with leads which might cause pinholes or tearing. The bottom, which is of modified fair form, is of 365 in. Alclad bolted through to wood struts and chines. The side covering, however, is thin cloth to guarantee it of fabric, and the top covering is of fabric, except for the portion of the hull below the waterline, as though a roadway grade deck, to standard Grade A aircraft cotton and the varnishes. The covering is heavily draped and waterproofed, and tests have indicated that the canvas so coated is more durable than the original fabric, and more than a meter thick at equal weight. A properly protected canvas is also highly resistant to deterioration from exposure to sea water. The use of a fabric skin also permits the use of double canvas in hull lines to improve aerodynamic properties, without requiring the use of compo-



The model B Privateer

The new  
Privateer

ated and reinforcing cloth for the proper forming of metal and plywood.

As before, the fuselage is a three-place pusher type enclosure with the engine mounted on a nacelle over the center of the hull. The most marked external change is in the abandonment of the single center support on the tail unit, in favor of a single four-leg tail boom.

The tail boom, which is detachable from the main hull at a point just above the steproot in a diamond-shaped勃艮地, consists of four longitudinal steel tubes, cross-braced at frequent intervals in both vertical and horizontal planes. The nose and tail boom feature cut to form the fair and provides support for the stabilizer and

gullwing. The entire boom structure is enclosed within a cylindrical housing of polished aluminum which will not carry any of the torsional or static loads. The covering is fastened securely into the aluminum at the head, and runs the fair. The tail boom is supported by two four-legged booms to the hull and to the engine mount, in

of conventional design.

The two spars are of wood, and ribs and stiffeners are of stainless steel. The radial and horizontal tail surfaces are also of stainless steel. All surfaces are fabric covered.

The connecting landing gear is similar in external appearance to that used in the old Privateer. An ingenious arrangement employing belt drive from the engine to the landing gear has been developed to provide the power for retrieving and extending the wheels. A standard not-wheel which acts as a water rudder completes the undercarriage. The wide up-flown nose of the standard Privateer construction has been eliminated, and the tail boom has been redesigned to improve their streamlining. An interesting feature is the incorporation of a six leg in the rear unit to protect the rear wing spar in case the fuselage strikes the ground.

The nose-wing modulus of the new Privateer has been designed that vision is in all directions, except directly to the rear, is practically unobstructed. Cockpit visibility is in as remarkable position, making it possible to get an overall or a top-down view of the field. Nose-in visibility is materially reduced by a large flying-bum, in the tail boom, and immediately behind the engine and propeller.

Steerable adjustment is obtained through the use of adjustable rod struts, as in former models, although the shape of the struts has been changed. The tail boom, which is detachable from the main hull, is a diamond-shaped勃艮地, consisting of four longitudinal steel tubes, cross-braced at frequent intervals in both vertical and horizontal planes. The nose and tail boom feature cut to form the fair and provides support for the stabilizer and

In the present model the power plant consists of a model A-70 Continental engine of 165 hp. Oil tanks are located in the engine nacelle, and the main fuel tank is in the hull in a 40-gal aluminum tank.

Crawford all-metal  
monoplane

A SIX-PLACE all-metal monoplane has recently been flown by the Crawford Metalplane Company, Los Angeles. The surface area of the high-wing full cantilever type, the wing being of multi-cellular construction sim-

The new Privateer  
115-hp Aeromarine engine. Aeromarine B-7 landing gear.

The Aeromarine B-7 biplane

ilar and tail surfaces are all metal, and wings are of the semi-biplane type, fabric covered. The aeronautical consists of machine gun, fire and sit, and a complete set of bombs slung beneath the fuselage.

A new model  
of the Bird

REFINEMENT of detail and the installation of a 170-hp Jacobs power plant now mark the new model C-1 Bird recently completed by the Bird Aircraft Corporation of Gleasons, N. Y. Although basically similar to previous Bird models in design and construction, the changes have been made to incorporate add both to its performance and its appearance.

This new power plant idea has been well applied to the new design, with result that the engine compartment has, ward of the fire wall, is unusually well protected. The engine is mounted on a single frame of increased clearance, which is advantageously arranged.

The landing gear is trunnion in that large nose and rear wheels are suspended from the under part of the fuselage by means of a short swing arm. The wheel fairings are elongated to provide clearance for the landing gear.

The machine is powered with a Wright Whirlwind engine of 220 hp. The general specifications are: Span, 20 ft; length, 36 ft 6 in.; height, 8 ft 3 in.; wing area, 240 sq ft.; gross weight, 3,500 lb.; wing loading, 15.9 lb per sq ft; power loading, 5.9 lb per hp.

Douglas B-7  
bomber plane

PHOTOGRAPHS have recently been released by the War Department of the new type of bombardment airplane, developed by the Douglas Aircraft Company at Santa Monica, Cal. The machine is of the increasingly popular high-wing monoplane type, powered with two Curtiss 14C-1 engines of 450 hp each. The 600 hp engines were obtained from the engine in two armoured nacelles. Oil cooler and pressure cylinders are suspended below each engine.

The general specifications are as follows: Length overall, 22 ft 6 in.; height overall, 8 ft 6 in.; span (maximum), 44 ft; wing area, 300 sq ft; gross weight, 4,520 lb; aerial load, 335 lb gross weight, 2,945 lb; wing loading, 12.5 lb per sq ft; power loading, 13.2 lb per hp.





NEW VOLUMES FOR THE SHELVES

JAPAN'S ALL THE WORLD'S AIRCRAFT, 1931, Edited by C. G. Gray and Edward Bridgeman, Sampson Low, Marston & Company, Ltd., London, 1931, 665 pages.

After twenty years of uninterrupted publication of the annual founded by the late Prof. Jules J. in almost superfluous to review it. It has become the standard reference work of the aeronautical world, to which one must necessarily turn whenever there is occasion to look at the characteristics of Japanese aircraft.

The present volume is as well planned, and has characteristics as complete, as any of the previous years. There is somewhat more general information than in any previous year, especially on air transport, operations and on the exports of Japanese aircraft. Figures are as well presented as anywhere.

Clear illustrations of the Japanese aircraft works this review, it would be proper to praise the work, and the review has been confined to a brief note of what the book contains. It can at least be claimed that it is an honest attempt to fill a serious gap in aeronautical literature.

UNITED STATES AVIATION REPORTS 1931; Edited by Arnold J. Knobell and Harry W. Johnson, Harry H. Knobell, Inc., Publishers, United States War Report, 1931, 155 pages.

THE AVIATION HANDBOOK, by Edward P. Warner and S. Paul Johnson, McGraw-Hill Book Company, 1938, 715 pages, 47.50.

HARD on the heels of the "British Handbook of Aeronautics" comes the first American attempt at the same. It goes much less deeply into theoretical matters, but considerably further into practical design data, than the British volume, and of course has the advantage of being derived from the American point of view. Like other aeronautical handbooks, it is a compilation rather than an original production, an attempt to bring together all the most important material to which the aeronautical engineer has frequent recourse to refer. Roughly speaking, 200 pages are devoted to aeronautics, 200 to flying field characteristics, 200 to airframe resistance, information, performance, aeroplane records and formulas, and 100 to aerodynamics, visibility and con-

ditions of safety. Particularly worthy of consideration, especially from the legal point of view, is the careful summary and classification of the various laws and regulations which govern the aeronautical business, which provides the reasoning of each decision or judicial charge.

Among the cases of particular interest covered in the present volume are the Eastern Air Transport case out and the passenger liability cases resulting from the Chinese Air Transport case in 1932, and the T.A.T. accident at Indianapolis late in the same year.

UNIFORM, by Léon, Claude, Charles E. Herresthal, Daniel, Maud & Compagnie, Paris, 1931, 33, 75 pages.

BOOKS on the rapid strides that have been made, and most of that that have been written, have presented the German point of view at least twice as often as the English. There has been an air raid, which has been a major operation from its inception as an American source as well as from the Aerowarfare Regulation of the Department of Commerce (Bollettino 8.8) and of the general implications for aircraft of the United States Navy. Weight data are also given for all standard aircrafts and parts and weight analysis for a number of typical types.

Since one of the features of the handbook works this review, it would be proper to praise the work, and the review has been confined to a brief note of what the book contains. It can at least be claimed that it is an honest attempt to fill a serious gap in aeronautical literature.

UNITED STATES AVIATION REPORTS 1931; Edited by Arnold J. Knobell and Harry W. Johnson, Harry H. Knobell, Inc., Publishers, United States War Report, 1931, 155 pages.

THE law between ever more important air routes, and operations of aircraft and airships, that they have been developed in the last three years in view of merely depending on service of counsel at every point. The annual volume of Aviation Reports that can be considered as addressed to legal counsel as well as to members of the Bar. For this reason, of view, it is almost impossible to make a general statement. It is a difficult and complex compilation of all decisions relating to the law of aviation in the courts of the United States and Canada, of all acts and federal statutes affecting aviation, and of various opinions of attorney general and of the administrative legal advisor.

MORE BUREAU'S MANUAL AND BUREAU AERONAUTICAL ENGINEERING, by Thomas L. Snyder, Dow's Publishers, Inc., New York City, 54 pages, 2.50.

FOR those interested in building aircraft aircraft, an aeronautics which has shown an especially noteworthy increase in recent years, particularly among youth active in handicraft, this should be a useful handbook.

## Glazed windows simulate fog

GLAZED simulation is used by operators of Miami drivers, Pan American Airways, to the passengers of all pilots as a substitute for flying, because the meteorological conditions over the routes often require flying by instruments for an hour or more at a time. The Miami drivers, Miami Airways Company, in its Brownsville base, a plane devoted to instrument flying instruction and practice. This machine, a Boeing 71, simulates the weather model in that the rear window is closed, and the front window is placed, in front of glazed windows rather than totally opaque material. The company has found that the soft grey light penetrating the "fog" through these glass apertures has the conditions simulated as actually flying through fog. Night flying is done by the compass.

## Travel planning bureau for business men

THE Business Travel Planning Bureau established Oct. 1 by American Airways to plan itineraries for traveling business men, utilizing airfares, schedules and other services of transportation, has to date figured out more than 5,000 trips, including airfares, airfares, and combinations of flights, which probably have a national de-

## TRANSPORT Operations and Traffic Management

business. About 25 per cent of the passengers have usually made the trip planned and in every case the traveler has been enthusiastic about the service. The object of the bureau is to enable men to get the best value for their little business time as possible on route. Two services parallel any part of the itinerary, that one which gives most business hours as recommended by the company.

A typical service of the bureau, for example, C. S. Harrison, president of the Illinois Motor Car Company of Dallas, recently had business which caused him to go west New York and Denver. The Dallas office of American Airways arranged all transportation for him, including a flight from Dallas to Port Columbus by American Airways and from Port Columbus to New York via railroads. Returning, he was raised to Delta United Air Lines and Transocean, by train and from Cincinnati to Dallas by American Airways.

The bureau is headed by a member of the traffic department and its members in New York City, with traffic representatives in each division specially assigned to the work of coordinating schedules. The bureau is a recognized division of the traffic department.

## Smoking permission approved by passengers

THE desirability of permitting smoking on passenger transports has been

since passage of policy over 100



The passenger terminal recently opened by Pan American Airways at the Panama City flying base on Balboa. The landing platform is shown at the end of the road.

scheduled operations started. In Europe it is common practice to permit smoking, but in this country aircraft have been divided on the question. Eastern Air Transport, prior to opening its new Air Transport Center, restricted passengers to the smoking section, and there only, in the forward compartment, though this rule often is overlooked when the plane is crowded and use of the compartment by all passengers waiting to smoke is impossible.

A typical service of the bureau, for example, C. S. Harrison, president of the Illinois Motor Car Company of Dallas, recently had business which caused him to go west New York and Denver. The Dallas office of American Airways arranged all transportation for him, including a flight from Dallas to Port Columbus by American Airways and from Port Columbus to New York via railroads. Returning, he was raised to Delta United Air Lines and Transocean, by train and from Cincinnati to Dallas by American Airways.

The bureau is headed by a member of the traffic department and its members in New York City, with traffic representatives in each division specially assigned to the work of coordinating schedules. The bureau is a recognized division of the traffic department.

## Pan American operates a flying boat base

CAREFUL selection has been paid to passenger comfort in the terminal building now serving Pan American Airways at its new flying boat base at Panama City. Many passengers spend on boats from provide comfortable living accommodations for those awaiting planes. The planes are launched from the dock at the end of the large.

The planes are launched by both crew and passengers in accordance with bell signals controlled by the port manager from his office. This method is very successful, it streamlines the departure routine, cuts down the general impression of efficient organization, and lessens the time of the passengers, particularly those who are not used to flying, as in the proper time to appear at the passenger gate. The crew goes aboard at the first signal, the passengers are admitted at the second.





**TEXACO  
AVIATION  
GASOLINE**  
*-tuned to your  
engine's best*



TEXACO AVIATION GASOLINE  
TEXACO AERODIESEL FUEL  
TEXACO AIRPLANE OILS  
TEXACO MARFAK GREASES  
TEXACO ASPHALT PRODUCTS  
FOR HIGHWAYS, HANGAR FLOORING AND APRONS,  
AND DUST LAYING

EVERY PILOT knows when he has Texaco gasoline that gives him the best in aircraft engine performance. There's the certainty of power, top speed and the feeling of complete dependability in the engine and its work.

That is Texaco Aviation Gasoline. And it is for these reasons that Texaco is so well and favorably known throughout the entire aviation industry—used and recommended by pilots in every section of the country.

Texaco Aviation Gasoline is made to advanced specifications which insure the highest efficiency as an engine fuel. A special grade is used—the most favorable for the manufacture of aviation gasoline—and the manufacture is centered in one Texaco refinery giving absolute control of every step of the process and final uniformity of the product.

Wherever you get it, Texaco Aviation Gasoline is always the name. Complete annual distributor makes it available at airports everywhere throughout the United States.

Texaco is a pioneer in developing better aviation fuels and lubricants. Write The Texas Company for information on Texaco Aviation Gasoline and Texaco Aviation Products.

THE TEXAS COMPANY, 135 E. 42nd ST., NEW YORK CITY

# AMERICAN AIRWAYS USES AIRWHEELS on Mail and Passenger Ships



*When you buy a new ship specify  
GoodYear Airwheels*

**GOOD**  **YEAR**

EVERYTHING IN RUBBER FOR THE AIRPLANE

Here are four different types of ships equipped with Airwheels, and there are many more with the same equipment in the great fleet of American Airways, with its scheduled flights of 28,826 miles per day.

With these great, yielding, rolling cushions on their landing gear, planes have a new independence over ground conditions, because they can land safely in mud, sand and soft terrain where any other type of equipment would make landings hazardous.

More than this, they reduce maintenance costs, protect planes from many repair charges, such as damage due to ground loops, and give passengers a new feeling of comfort and security in landing and taking off.

Only GoodYear builds Airwheels. Only GoodYear can give you Airwheel safety. For full data and engineering recommendations, write or wire Goodyear, Akron, Ohio, or Los Angeles, California.





**S**INCE September 1930 The Ludington Lines' every hour on the hour New York, Philadelphia and Washington service has become the accepted mode of travel by business executives and men of affairs. In serving so successfully the distinguished patronage, the prestige and popularity of The Ludington Lines indicate an enviable mastery of air transportation. This growing popularity, expressed by a steadily increasing volume of traffic, has necessitated additional equipment . . . Guided by the knowledge and experience resulting from the record of 2,060,634 miles flown, and 87,329 passengers carried since its inception, and by the minute under-



and

The Burlington Airlines, Inc.—with the equipment of the world's markets available — chose THE FLEETSTER. **THE FLEETSTER**  
CONSOLIDATED AIRCRAFT CORPORATION • BUFFALO • N.Y.



Stanava-fueled planes of Inter-Island Airways link all Hawaii with a regular monthly flying schedule of 23,000 miles.

The unique, well-established and efficient service of Inter-Island Airways is no less popular among the people of Hawaii than among tourists. Organized but two years ago, its four amphibious and one single-motored

cabin monoplane have carried over 25,000 passengers 600,000 miles. Its schedules have been maintained with practically one hundred per cent regularity.

Like many other lines in the Americas, Europe, and elsewhere, Inter-Island Airways finds Stanvo Aviation Gasoline best suited to its requirements, and uses it exclusively.



**STANAVO**  
AVIATION GASOLINE  
AND ENGINE OIL

STANAVO SPECIFICATIONS BOARD, Inc.

Standard Oil Company of California  
111 South Figueroa Street

Standard Oil Company (Indiana)  
11111 North Meridian Street, Indianapolis

Standard Oil Company of New Jersey  
41 Broadway, New York City



with an ear to the ground!

*Exide Aircraft Batteries keep watch over radio . . . make messages certain*

WHEN "snap" suddenly up the sun—blaze our horizon lights—that's when radio and position (navigation) lights must be shipshape. We'll be glad to tell you more about the many types of Exide Aircraft Batteries. Just drop us a wire today.

Exide Aircraft Batteries protect these vital parts . . . give reliable service at all times.

What's more, they're built to fly. Ask your pilot friends. They'll tell you that Exide air lights and starters, that the electrolyte will not spill, that they are safe and reliable—that Exide Aircraft Batteries last longer.

**SEND IT VIA AIR MAIL**

During the past 15 years on which Exide Aircraft Batteries have been in use, less than 0.005 of 1 per cent of mail has been destroyed.

Dependable Exide Aircraft Batteries, standard equipment on most mail and transport ships, contribute to safety factors.

**Exide**  
**AIRCRAFT**  
**BATTERIES**



Contractors to  
the U. S. Army and Navy

**THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia**  
THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE  
*Exide Batteries of Greatest Lengthened Service*

# SPEEDY Ground Work

Caterpillar Tractor Co., Peoria, Ill., U.S.A.  
Track-type Tractors Road Machinery  
Combines

(Photo: a "Caterpillar" Dumper Near You)

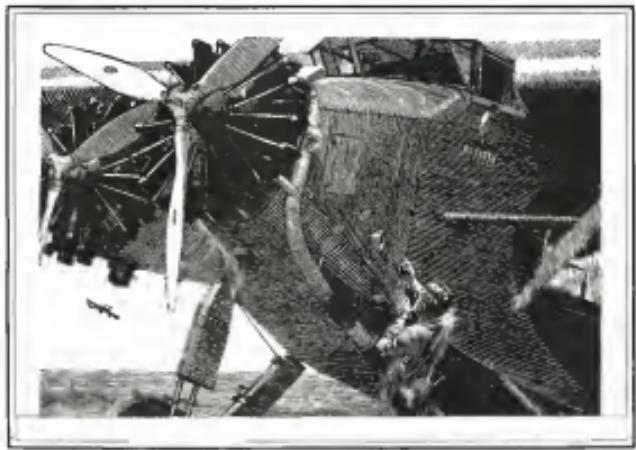
Pounds—1 cu. yd. Peoria Dumper		
TEN	1100	THIRTY
FIFTEEN	1100	THIRTY-FIVE
TWENTY-FIVE	1100	FIFTY
THIRTY	1100	SIXTY

MODERN planes provide speedy transportation. And modern tractors — "Caterpillar" Tractors — put speed and ardorless into the ground work. The picture below was taken at Carter Field, Atlanta, Georgia — a similar one could have been taken at scores of other airports, large or small. With a "Caterpillar" on the job, outgoing ships are swiftly, easily swung into position on the runway — incoming ones are promptly trucked into the hangars. Pilots and public alike appreciate the power facilities and efficiency of airports "Caterpillar"-equipped.

**CATERPILLAR**  
TRACTOR  
MANUFACTURERS



# OIL FAILURE Destroys Motors Cuts Power »» Causes frequent costly overhauls



**Tough-Film Pennzoil cuts repairs—  
Costs less per hour of flying time**

**OIL FAILURE** starts when heat thins out poor oil. It leaves moving parts unprotected. It damages every wearing surface—cuts down r. p. m.—wastes power and causes frequent overhauls.

Because Tough-Film Pennzoil is double-refined, it flows freely, yet maintains a safe, tough film at any engine temperature. It penetrates easily into close-finned bearings, gives protection that increases the period between overhauls. It gives more flying hours between fillings, at lower cost per hour.



Pennzoil is 100% Pennsylvania Crude Crude Oil Above

**THE PENNZOIL COMPANY**  
Executive Office and Refinery, Oil City, Pa.  
District Offices: New York, Chicago, Los Angeles  
Beloit-American Oil Co., Ltd., Sole Distributor in  
Quebec and Quebec, Canada  
PENNZOIL is made by the famous Pennzoil Process from 100% pure  
Pennsylvania crude and nothing else

**RADIO:** Enjoy The Pennzoil Parade every Sunday  
among our nationwide Columbia Networks



theoric at these exceedingly low temperatures."

Pilots	40 Below Zero	Safe	50 Below Zero
Rating	35 Below Zero	McGrath	37 Below Zero
Unloaded	41 Below Zero	Torres	55 Below Zero

Wright engines power millions of miles of transport travel every year. Their dependability under the trying conditions of intense heat and severe cold has made Wright the choice of air mail and passenger operators around the world.

Contractors to the Governments of the World

CURTiss  
Contractor and  
Orchestrator



WRIGHT  
Contractor and  
Orchestrator

**WRIGHT**  
AERONAUTICAL CORPORATION  
PATERSON NEW JERSEY  
A DIVISION OF CURTISS-WRIGHT CORPORATION

# WRIGHT ... ENGINE PERFORMANCE at 50° below ZERO

PACIFIC INTERNATIONAL AIRWAYS OF ALASKA  
operates a mail route between Nenana and Unalakleet,  
via the Yukon River. Wright-powered planes are down  
daily, over that route, in temperatures ranging from 40°  
to 60° below zero—see *let Pilot Cope tell the story*.

"... You may be interested to know how well Wright  
Motors are operating in temperatures far below zero. Just  
for proof I am listing below the prevailing temperatures  
along my route on January 7, 1932. I have checked the  
says I make daily, and have never been held up a single  
day on account of cold weather.

"I am flying a 400 mile mail route, making seven landings  
and take-offs daily, and I want you to know that the old  
Wright Whirlwind 300 has never yet failed to answer the



WHIRLWIND  
300 HP

Three Squadrons of Diving Bombers  
Now Being Built for U. S. Navy



Setting new records for bombing plane performance, the multi-new Marian Diving Bomber performs loops, rolls, Immelmanns, inverted flying and other acrobatics impossible except by use of aircraft planes.



The first Marion Bomber, built in 1918, was perhaps the most famous plane of its time. This forerunner of a long line of Marion Bomber Planes possessed a surprising number in the engine driving Bomber of today.

SEVERAL attempts had been made. But no plane ever built before could withstand the terrific strain imposed upon the Martin Diving Bomber as it made one flight. Diving vertically from a height of 12,000 feet with a 3,000 pound bomb slung beneath the fuselage. Attaining a speed of more than four miles per minute. Pulling up sharply from the dive with the bomb still in place. Repeating that dive over and over again.

That was months ago. Then came a year of rigorous trials in service. Then official approval. Now one squadron of Flying Buffaloes is being delivered to the United States Navy and two more squadrons are under construction.

"Why did Marlin succeed where others had failed? Because Marlin leaves nothing to chance. A series of brand tests—surpassing anything ever heard of before—had proved the dependability of every detail before the Dining Room took to the air. Nowhere else in the industry can aircraft of equal quality be produced in quantity at lower cost."



Typical of the case which produced the Diving Bitterling, a circumferential reinforced shell type fastening was buckled and caused to disintegrate. The first successful test of a full scale metalized shell body in America.

nimble feet



# BENDIX

Wheels and Brakes

Keeping ground efficiency abreast with flying ability are Bendix Wheels and Brakes for airplanes—the pioneer product of its kind, the nimble feet of modern aircraft.

They fully express the Bendix enthusiasm for quality leadership, for progressive development.



Easier control, better maneuverability, greatly increased safety, reduced take-off runs, simplified landing — all these advantages are built into this equipment.

The line is completely types with roller-bearing wheels (a Bendix development); and low-pressure wheels.

**BENDIX BRAKE COMPANY**  
SOUTH BEND, INDIANA

# BENDIX AIRPLANE WHEELS and BRAKES

For more information, contact the Office of the Vice President for Research and the Office of the Vice President for Student Affairs.

# Boeing training is built on flying 37 million miles with the Air Mail

**T**HREE MILLION of flights around the world by flight, all on an even schedule at times, in addition to one million miles of student instruction flying, is an inestimable advantage to be brought you by your flying school.

It means that your training, from the ground up, will be basic and firm.

Boeing School of Aeronautics has a larger regular enrollment than any other recognized school. In fact of eight training planes outside the famous Boeing 40-C4, the eight-place Mandan all-metal cabin monoplane, Seven Junior cabin monoplane, the Boeing 81 trainer, the new Starliner trainer, and the famous Boeing 103 trainer—powered with

motors ranging from 165 H.P. to 415 H.P. It comprises the most modern instruments, classroom and shop equipment in one school. Located in California, on the famous Oakland Municipal Airport, it has the advantage of all-year flying weather.

The Boeing School is definitely built to meet the forces of tomorrow, backed by the manufacturing and transport organization with the world's largest stake in that future. Free the service will pay you to turn this training to your own advantage.

A bulletin of course, cost and facilities will be mailed you upon request. Compare our courses with those offered elsewhere before choosing your school.

*Next regular enrollment, April 4, 1932*

# BOEING SCHOOL OF AERONAUTICS

Subsidiary of United Aircraft & Transport Corp.

BOEING SCHOOL OF AERONAUTICS	
Room 8-3, Airport, Oakland, California	
Gentlemen: I am interested in	
(Check one)	
<input type="checkbox"/> Passenger Plane	<input type="checkbox"/> Boeing Model 75
<input type="checkbox"/> Commercial Plane	<input type="checkbox"/> Boeing Model 80
<input type="checkbox"/> Largest Commercial Plane	<input type="checkbox"/> Boeing Model 81
<input type="checkbox"/> Transport Plane	<input type="checkbox"/> Boeing Model 103 (For the open cockpit)
Home _____	Age _____
Address _____	City _____
City _____	State _____

## The first BOEING flying boat outlasted seven engines\*

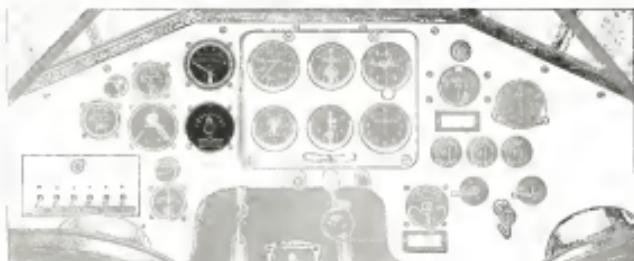


After nine years of air mail service between Seattle and Victoria—1919 to 1928—totaling more than 500,000 miles, this strauch ancestor of later commercial models was still in air-worthy condition — another instance of Boeing construction years ahead of its time. . . . Boeing Airplane Company, Seattle, Subsidiary United Aircraft & Transport Corporation.



\* BOEING  
has always built  
tomorrow's airplanes  
TO-DAY

LOOK TO ELECTRIC INSTRUMENTS for PERFORMANCE at LOW COST



## The G-E Engine-Temperature Indicator and 9-Cylinder Selector Switch

The cylinder temperature of an air-cooled engine is not the temperature of the lubricating oil. Unlike the conditions in a liquid-cooled engine, heating or cooling may take place at a high rate without a corresponding response of oil-temperature instruments. Therefore, the G-E engine-temperature indicator has an important function, for it measures accurately and instantaneously the temperature of any "hot spot" such as a cylinder wall or head. It consists of an indicating instrument connected by small twin-conductor leads to a thermocouple washer used as a spark-plug gasket. This instrument is accurate and reliable; it automatically corrects for changes in air temperature, so that you can be certain of correct readings regardless of altitude or the temperature of the surrounding air. It requires no batteries and is not connected to the ignition system. Ask for Bulletin GEA-118TC. Address: General Electric Company, Schenectady, New York.

Here are the G-E engine-temperature indicator and selector switch. By means of the latter, the pilot can read individual cylinder temperatures on the dial of the indicator.

**GENERAL ELECTRIC**  
AERONAUTIC EQUIPMENT

SPECIALISTS IN NEW YORK, WASHINGTON, DAYTON AND LOS ANGELES



# THE TAYLOR CUB

## A ship that has proved itself

THE TAYLOR CUB has proved its worth in student instruction and private flying and has an obvious need in Aviation. The low price of \$1925 opens an enormous market heretofore unoccupied. It is the most outstanding value ever offered—a real airplane with full size, comfortable, dual control cockpit, low pressure tires and standard instruments, built for strength and performance, perfectly stable in every maneuver and an honest landing speed of 26 miles an hour. For these reasons, the TAYLOR "CUB" stands alone in a class which it has made for itself. A full quality airplane for less than \$1500—much less. It is the common sense plane for flying school, flying club, and pleasure flyer alike. Dealers and distributors, don't pass this opportunity by. It is your chance to show a big profit for 1937. Soon valuable territory will open West or West at once. Let us help you get under way before the Detroit Show and make the most of 1937.



- Excellent Vision
- Easily Accessible
- Convenient
- Comfortable
- A. T. C. No. 455

**\$1325 FLYAWAY FIELD**  
with Continental A-40 Engine  
FLY Taylormade AIRPLANES

**TAYLOR**  
AIRCRAFT COMPANY  
Bradford,  
Pennsylvania

# Do a little "GROUND FLYING"



Check up on your oil as carefully as you do your ship and motor

THANK to the pilot who uses Gulfpride Oil and his will tell you that an expensive square with the findings of leading aviation engineers.

Gulfpride Oils show remarkably flat viscosity-temperature curves... they hold their body under high operating temperatures.

yet they never become rubbery stiff and sticky at low airmen temperatures. Gulfpride Oils seldom feel up the motor with carbon. Gulfpride Oils give you more power from your motor.

Technical men could tell you that Gulfpride Oils are refined by the Alkanol Chloride process, which employs materials costing \$100 per ton instead of the \$50 per ton acids commonly used.

That explains why pilots who demand the best in lubricants use Gulfpride Oils.

GULF REFINING COMPANY  
General Sales Offices: Pittsburgh, Pa. U.S.A.

**gulfpride  
Oil**

## MORE AIR HOURS

Gulfpride Oil is 100% aviation base mineral oil refined by the Alkanol Chloride process. It is the answer to "Ground Flying." Gulfpride Oil satisfies a relatively low viscosity requirement for aircraft engines and fuel tanks, and low viscosity.

Gulfpride Oil holds the leading position in aircraft lubricants and fuel tanks, and is leading in the field of aircraft cooling systems.

Gulfpride Oil is used in the aircraft cooling systems of the Boeing Model 200 and 210, P-2, P-3, and Douglas Model 10, all types of bombers, and all types of fighters.

Ask for Gulfpride Oil and you'll never be grounded again... you'll never need to.



• GULF REFINING COMPANY •

# ANOTHER FAMOUS PILOT selects the BIRD



Wiley Post (who with Harold Gatty holds the record for the fastest flight around the world) is taking delivery of his new airplane, 125 H.P. "Kinner-Bird." Wiley Post is the new Bird distributor for Oklahoma and Texas.

In addition to our present authorized dealers and representatives, (COLUMBIA-REED, FLYING SERVICE, INC., in California) the Bird plane is being held in the class and has been authorized to represent us on Sales and Service throughout the United States through their thirty branches and 385 dealers.

(The individual cylinder head stressrelieving shown above is special equipment.)

## The BIRD CHALLENGE for 1932

The most advanced and reasonably-priced line of open cockpit aircraft ever made have been incorporated over 800 recent improvements.

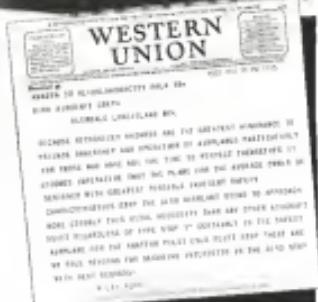
Bird planes invite comparison in performance with any others in their power range—including planes equipped with water cooled, dual, large or variable cylinder wings. All Bird planes may now be purchased on liberal terms. Write for full information.

SEE THE COMPLETE BIRD LINE AT THE DETROIT SHOW, APRIL 2-10, 1932

BIRD AIRCRAFT CORPORATION, Glendale, L. I., New York



THE SAFE AIRPLANE



WIRE TO BIRDS  
WESTERN UNION

</div



# 110 planes 34 ground stations . . .

equipped with

*Western Electric Radio Telephone*  
by **AMERICAN AIRWAYS** Inc.



Flying over 875,000 miles a month, serving 60 cities from coast to coast and from Canada to the Gulf, American Airways has built up a fine record for dependability. And Western Electric Radio Telephone—by keeping pilots constantly in touch with dispatchers—has helped to make this record possible.

Along the 337 miles of airways over which American operates, 34 ground stations have been equipped with Western Electric Radio Telephone apparatus for guiding and instructing pilots en route. And 110 planes are

Western Electric equipped—65 for transway Radio Telephone communication, 47 for receiving radio lesson signals and 4 for porters of Commerce weather broadcasts.

There's Western Electric Radio equipment designed for small planes, too—light, compact and easily installed. For details, write to Western Electric Company, Department 2704, 195 Broadway, New York.



Western Electric-equipped routes of American Airways Inc.

**Western Electric**  
Aviation Communication Systems

Made in the U.S.A.



BY AIRL. TELEPHONE

*Western Electric in Canada*

FAMOUS FLIGHTS WITH THOMPSON VALVES

# 8

This is a development in one of a series  
of record-breaking altitude airplanes built in  
which Thompson Valves were used.



## TO BREAK THE WORLD'S ALTITUDE RECORD



80 degrees below zero in June! Even the most imaginative Arctic explorer could not match a story like that. Yet this summer on the wing of his Wright Apache record holder, temperature on June 4th, 1936, when Lieutenant Smith, indomitable Navy flyer, set the present world's altitude record for land planes—at 40,100 feet!

Two hours in the air—climbing steadily—Lieut. Smith found his Pratt & Whitney Wasp passed higher and higher—till beyond 40,000 feet his propeller began to let the thinning air without taking hold. Wearing a self-developed breathing apparatus and electrically heated goggles, Smith went upward doggedly to the new record—and came in the engine-worn record of the plane he had been flying when setting 38 degrees below zero.

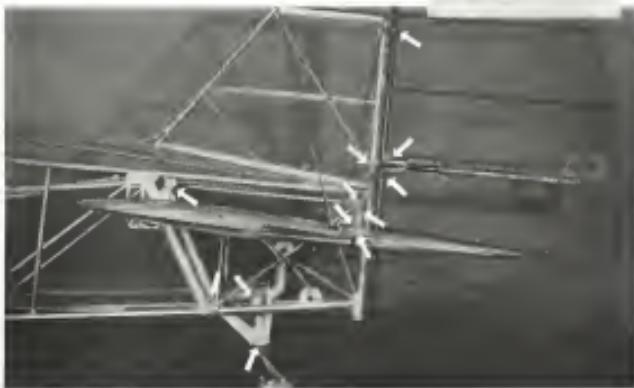
But the Skyblader "Wasp" performed faultlessly, adding again to its long list of achievements. And in that engine, were valves supplied by Thompson Products, Inc.

THOMPSON PRODUCTS, INCORPORATED  
General Office: Cleveland, Ohio U. S. A.  
Factories: CLEVELAND and DETROIT

**Thompson Valves**

# Plane Controls

*...all Ball Bearing*



*100 Fafnirs on new Consolidated Trainer  
for smoother operation and lower maintenance*

CONTROL spares, landing gear, C-rod ends, brake controls, cylinder adjustments and a majority of the other moving parts of the new Consolidated Trainer developed for the U. S. Army Air Corps Fast

turn friction-free and service-free on 100 Fafnir Aircraft Bearings. This wide-spread use of ball bearings on a plane of this type demonstrates the fact that the advantages of smooth and dependable operation, elimination of costly overhauling, and saving of weight and space made possible with Fafnirs, and not confined to costly ships.

The wide range of types and sizes of Fafnir Aircraft Bearings, including seal and cartridge designs, assures the choice of the correct

bearing for every airplane service. Whether for engines or control systems there is a Fafnir Bearing possessing the proper characteristics.

Plane builders are finding, as Consolidated has found, that with ball bearing application "functioning is greatly improved" and "maintenance troubles eliminated."

**Fafnir Aircraft Data Sheets** contain valuable and practical information concerning load ratings, dimensions, and recommended uses.

THE FAFNIR BEARING COMPANY,  
NEW BRITAIN, CONNECTICUT  
Atlanta • Chicago • Cleveland • Cincinnati  
Dallas • Denver • Los Angeles • Milwaukee  
Norfolk • Newark • New York • Philadelphia



*Engineering quality*

## FAFNIR BALL BEARINGS

# BELLANCA

*will be at Detroit*

WITH NEW ANNOUNCEMENTS

ABOUT BELLANCA PLANES

BELLANCA leadership once more will be assured at the National Aircraft Show in Detroit. Sales gains and popularity will not be the only basis of this claim. Bellanca performance records will again confirm the superiority of Bellanca planes. The new announcements to be made at Detroit by this company will also provide renewed evidence that Bellanca design keeps always to the forefront, always a step in advance of the needs of air transportation.

If you are considering the purchase of new equipment and comparing values now on the market, it will pay you to wait until you see the 1932 Bellanca exhibits at Detroit, unless you prefer to view these models under construction at the Bellanca factory, New Castle, Delaware, before March 28th, making the trip as the company's guest in one of its demonstration planes.

BELLANCA AIRCRAFT CORPORATION  
New Castle, Delaware

Chrysler Building, New York

Bellanca Aircraft of Canada, Ltd., Montreal

# BELLANCA

BUILT AS ONLY BELLANCA CAN BUILD

# SIZING UP *this industry of ours*

THIS year the National Aircraft Show at Detroit, April 2-10, and the Annual Show Number of AVIATION will for most interested people definitely indicate the place occupied by the airplane in the American economic scheme. The business man, the investor, the potential user will, at Show time, critically size up the present-day industry, its products, its leadership and prospects.

For those who attend, the April issue of AVIATION will provide a guide to their general interests and contacts at the Show. It will contain a list of exhibitors, forecast of exhibits, program of meetings and other useful information. In addition it will present a consensus of opinion of current problems by outstanding executives of the industry. The advertising pages will reflect the confidence of prominent manufacturers who serve the industry.

To the thousands who are unable to go to Detroit, the Show Number will be equally interesting. More than seven thousand copies will be printed for subscribers and newsstand buyers.

Advertising forms will close March 18; three days earlier for color.

*Annual Show Number—April*  

# AVIATION

1882 *Golden Anniversary* 1932

**FIFTY YEARS**  
**IN THE FRONT RANK OF PROGRESS**

In dim geologic ages, Nature created beneath an extensive area in northwestern Pennsylvania her supreme achievement in petroleum—the rare crude oil containing outstanding lubricating qualities and now known as the "Bradford" Grade. Fifty years ago, Kendall Oil was first refined from this famous crude. Throughout the fifty years since, it has been derived from no other source.

In perfection, Kendall refining processes have been in keeping with the fine quality of the crude. No seeds or harmful chemicals endanger the fine goodness of the oil. No expense or effort is spared to make each drop of oil pure, uniform, capable of unusual service.

During this eventful half century, which has seen the development of high-speed industrial machinery, the automobile and the airplane, Kendall Oil has kept pace with the need for friction-reducing, enduring, efficient

lubrication. Aviation, like other industries, has learned the net worth of Kendall. It has experienced Kendall's abundant fulfillment of every need.

On its Golden Anniversary, Kendall extends its appreciative thanks to those progressive men and women in aviation, whose confidence and support have led it to new triumphs and greatest success.

Kendall Oil is sold at leading stations throughout the nation. Write for the list of these together with complete details of Kendall quality. Address, Kendall Refining Company, Bradford, Pennsylvania.

Use the Kendall Exhibit at the Detroit Show—April 2nd to 10th. That happy character "Old Mac Kendall" will be on hand to renew acquaintances and answer slippery questions.



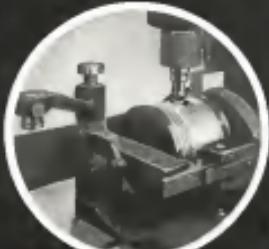
The Kendall Refinery in 1912 and the early days of five men—excluding the trustees. The white building beyond the scene, behind it is the "clerk box" crude still. The men in the team and wagon are the early "piping line" from the wells.

**KENDALL OIL** REFINED FROM 100%  
BRADFORD GRADE OF  
PENNSYLVANIA CRUDE

*Use the Air Mail!*



# PRECISION PARTS



## DIAMOND BORING to plus or minus .0002

The importance of uniform accuracy of parts is particularly evident in aircraft construction. It is now easily and inexpensively obtained in work done on the Diamond Test Boring Machine.

The illustration shows a Diamond Test Boring Machine installed in the Chicago Avenue shop where, by its use, precision accuracy of hub diameter and bore diameter of both hubs in a propeller is obtained.

Rigid adherence to exacting standards and exacting tolerances is made possible by precision speed with the Diamond Test Boring Machine.

**GOVRO  
NELSON  
COMPANY**  
1931 ANTOINETTE • DETROIT



## Where there is no landing there must be no failure

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